



1938

ARCHITECTS AND ENGINEERS

BUILDING AND CONSTRUCTION

DATA BOOK

Useful Information

FOR ARCHITECTS AND ENGINEERS

TYPICAL SPECIFICATION

PRICE ESTIMATING CURVES

Special attention has been given to the inclusion of typical specifications in a manner that will be useful to architects and engineers. Furthermore some price estimating curves have been included at the back of this section. The information on each piece of equipment has been arranged to include all the information given under the following headings:

APPLICATION The conditions under which this particular piece of equipment would be used in building are stated briefly.

FEATURES The distinctive or outstanding design features of the device particularly those important in building are given. Westinghouse features are covered with a maximum of fact and a minimum of ballyhoo.

HOW TO SELECT The procedure to be followed and the necessary steps to be taken in selecting the proper device for the conditions under which it will operate are given.

DIMENSIONS Sufficient tabular information is given wherever practical to obtain such information as height, width, depth and weight. This information often very necessary in design can be obtained from the tables after the proper size has been selected.

TYPICAL ARCHITECTS SPECIFICATION The suggested specifications have been carefully reviewed by architects and engineers familiar with this type of equipment. They are written so that you will be sure to get the type of equipment you expect. However, the specifications do not in any way limit you to Westinghouse equipment.

WHERE TO BUY Under this heading the source of additional information has been indicated as well as the publication from which more detailed information can be obtained.

WESTINGHOUSE PRODUCTS

From incoming power line to driven machine and lighting Westinghouse can supply full electrical needs. This list includes hundreds of items including motors of all sizes, control, pro-

TECTIVE DEVICES—circuit breakers, nofuse load centers, panelboards—lighting equipment, mazda lamps, elevators, household equipment and mechanical equipment such as stokers turbines.

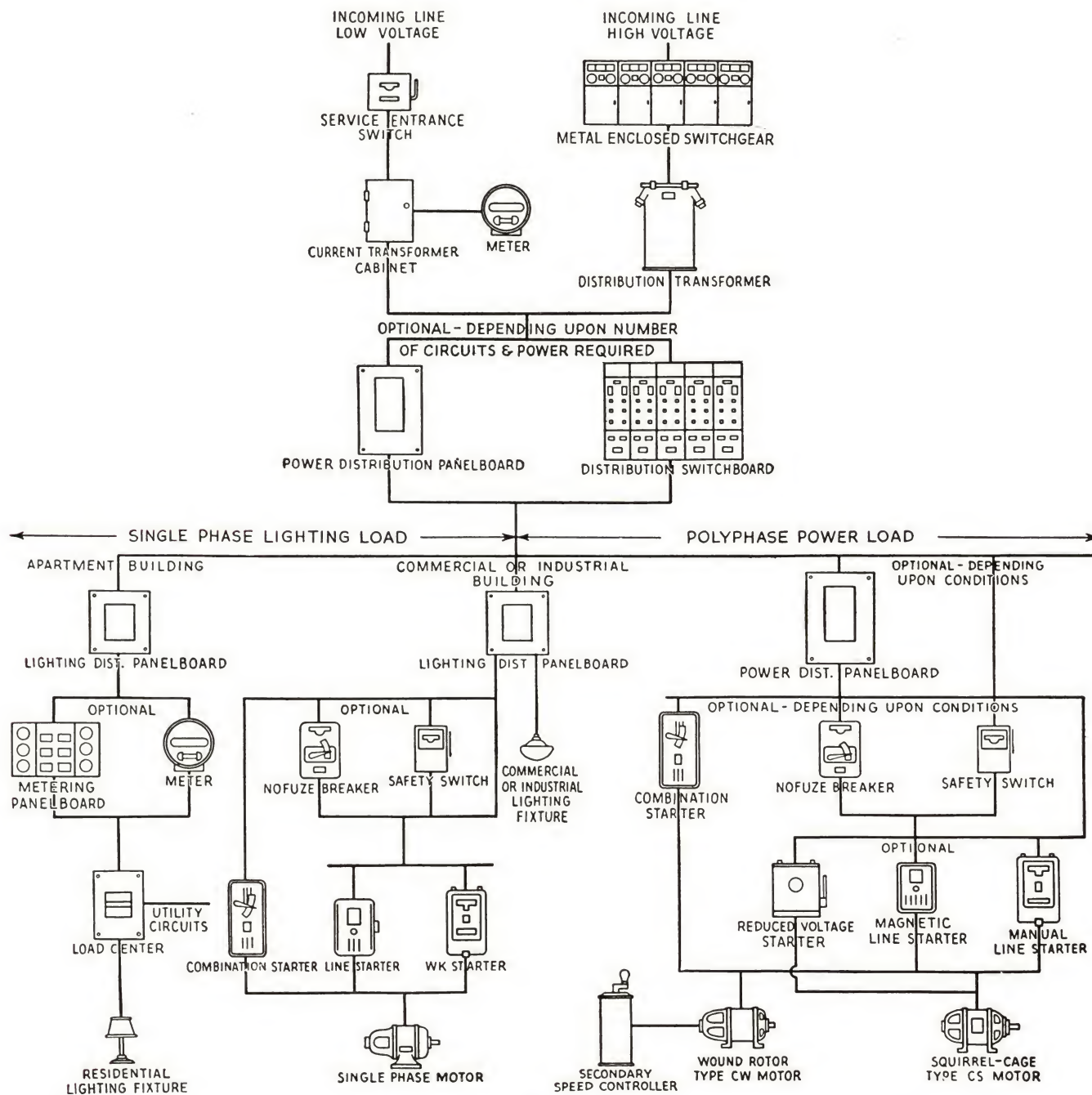
WESTINGHOUSE SERVICE

District warehouses and service shops make possible prompt service and delivery on orders. These facilities are supplemented by more than a hundred agent jobbers who in addition to Westinghouse equipment have a complete line of electrical wiring supplies.

For specialized assistance in any of your problems Westinghouse maintains a Construction Industry Department at Headquarters and in District Offices. This staff of engineers is experienced in the electrical problems of the building industry. They will be glad to assist you with any of your electrical problems.



DIAGRAMMATIC INDEX SHOWING WESTINGHOUSE EQUIPMENT FOR THE DISTRIBUTION, CONTROL AND UTILIZATION OF ELECTRICAL ENERGY



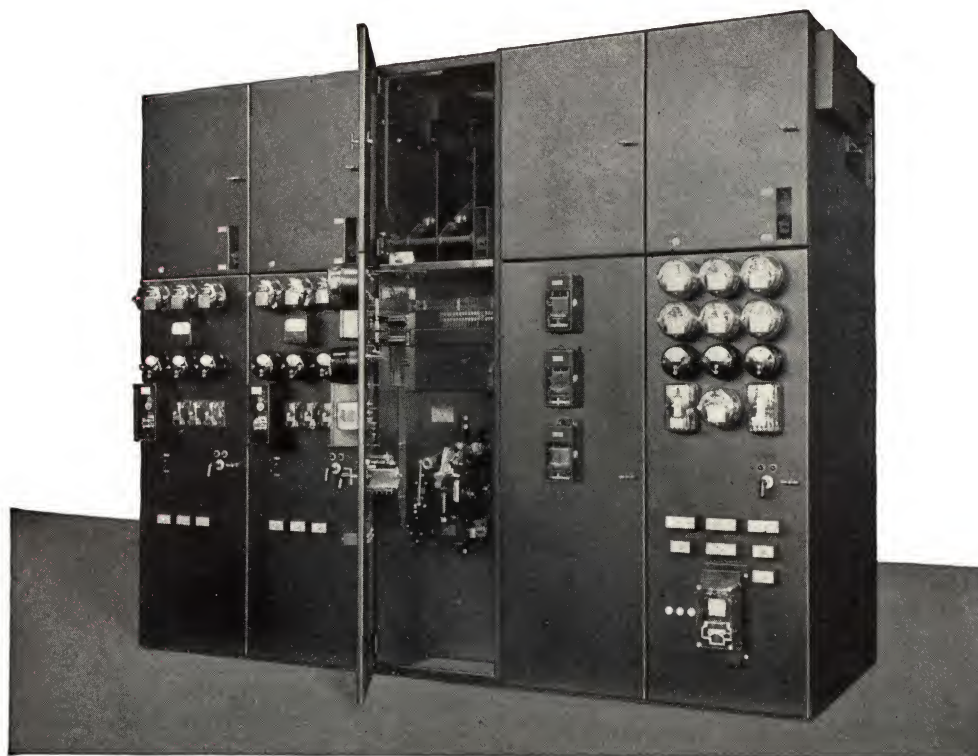
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CUBICLE TYPE SWITCHGEAR



Front View
of Typical
Cubicle
Structure

APPLICATION

Indoor cubicles provide complete factory assembled, steel enclosed, safety type switching equipment at minimum expense. They can be used for distribution substations, providing control for motors, generators, incoming lines and feeders. The units

are for either manually or electrically-operated oil circuit breakers and may be equipped with automatic reclosing relays, if electrically-operated, which will reclose the circuit breaker a definite number of times on a predetermined schedule.

FEATURES

COMPACT—The oil circuit breakers, switchboard, instrument transformers and disconnecting switches are combined in one structure.

EASY TO INSTALL—Cubicles are factory assembled.

SAFETY FOR THE STATION ATTENDANT—All live parts are completely enclosed to prevent accidental contact. The high tension compartment is isolated from the low-tension compartment if the extended front hinged panel arrangement is selected.

LOW MAINTENANCE—The steel enclosure provides maximum protection for the component parts. Hinged doors and removable steel plates allow ready access to the interior of the cubicles.

GOOD APPEARANCE—The cubicles are neatly finished in dull black and present a pleasing appearance.

EASY TO MOVE—The cubicles can be moved from one location to another with a minimum of expense.

HOW TO SELECT

The base item (consisting of circuit breaker, enclosure, disconnecting switches, copper bus, ground bus and secondary and control wiring) should be selected from the table, after

determining the required breaker rating. The base item covers the simplest arrangement. Additional features should be selected from the optional equipment and specified as required.

TYPICAL SPECIFICATIONS

Base Item

ENCLOSURE—The cubicles are to be constructed of formed sections of $\frac{1}{8}$ inch thick cold rolled stretcher leveled steel welded together, and reinforced, where necessary, with structural steel members. The completed units to be rigid and self-supporting and each unit to be isolated from adjacent units by steel barriers. The oil circuit breaker compartment is to be enclosed on the rear by means of a removable steel plate. Provide a hinged door for access to disconnecting switches.

FRONT PANEL—Provide a stationary panel for mounting instruments, relays, control switches, oil circuit breaker mechanisms and other devices.

DISCONNECTING SWITCHES—All disconnecting switches are to be hook-stick operated, provided

with latches to prevent opening during short-circuits. Supply insulating barriers between disconnecting switches.

BUSES—Bare copper buses are to be carried on porcelain bus supports near the top of the structure. All main primary connections inside the cubicles to be made with bare copper bars.

CIRCUIT BREAKERS—Each cubicle is to be equipped with a three-pole, single throw, oil circuit breaker of required rating. The circuit breaker will be (a) manually operated, (b) direct current, solenoid operated or (c) alternating current, Retox-Solenoid operated. The circuit breaker to be provided with necessary auxiliary devices, including an alternating current or a direct current tripping coil.

Cubicle No. shall be equipped with a 3 pole, single throw oil circuit breaker—Westinghouse Type or



approved equal, rated at.....Volts.....Amps.....
KVA interrupting capacity. (Repeat for each cubicle.)

GROUND BUS—The cubicles are to be equipped with a ground bus of 2 inch by 1/4 inch copper bar, bolted to the cubicle steel work and connected to breaker frame by a copper strap.

SECONDARY AND CONTROL WIRING—Necessary secondary and control wiring complete with accessories is to be supplied. Provide terminal blocks for all secondary and control connections leaving the cubicle structure.

FACTORY TESTS—The cubicles are to be completely assembled, wired, and tested at the factory. Primary and control circuits are to be given over-potential tests to make certain that the insulation is ample for the service voltage. In addition to a careful inspection and check of wiring, the equipment is to be given an operation test to make sure that it functions properly.

The cubicles and all apparatus included in them are to conform to the latest standards of the A.I.E.E.

INSTALLATION—The cubicles are to be shipped completely assembled so that the installation work will consist only of bolting the units to the foundation and to each other, installing the bus bars, attaching the main and control cables to their terminal points, taping joints in main connections (where required) and filling the circuit breaker tanks with oil.

Optional Equipment

{Select and Specify as required}

OPTION 1—CURRENT TRANSFORMERS—The necessary current transformers of required ratio are to be supplied.

OPTION 2—POTENTIAL TRANSFORMERS—The necessary potential transformers of required ratio, complete with primary fuse and resistors are to be supplied. (Where transformers cannot be mounted inside cubicle, they shall be enclosed in a separate sheet steel compartment mounted above cubicle.)

OPTION 3—INSTRUMENTS AND RELAYS—The necessary instruments and relays, and control, instrument and test switches, as indicated on the plans or specified herein are to be supplied. (Specify to suit requirements.)

OPTION 4—EXTENDED FRONT HINGED PANEL AND ISOLATING BARRIER—Provide a hinged front panel of 1/8 inch thick cold-rolled stretcher-leveled sheet steel, for mounting

instruments, relays, control switches and other devices. A steel barrier is to be supplied for isolating the oil circuit breaker mechanism and all control equipment from the high tension equipment. (Omit stationary front panel from base item.)

OPTION 5—HINGED REAR DOORS—Provide a hinged steel door on rear of each cubicle to allow access to breaker compartment. (Omit removable steel plate from base item.)

OPTION 6—WIRE-GLASS WINDOW—Provide a wire-glass window in the door in front of the disconnecting switches to permit observation of the disconnecting switch position.

OPTION 7—GANG-OPERATED DISCONNECTING SWITCHES—All disconnecting switches are to be gang-operated by means of a removable operating handle. (Omit hook stick operated disconnecting switches from base item.)

OPTION 8—INTERLOCK BETWEEN BREAKER AND GANG-OPERATED DISCONNECTING SWITCHES—Provide an interlock between oil breaker and gang-operated disconnecting switches, which will prevent the disconnects from being operated when breaker is in closed position.

OPTION 9—INTERLOCK BETWEEN GANG-OPERATED DISCONNECTING SWITCHES AND DOOR—Provide an interlock between gang-operated disconnects and rear door to prevent access to breaker compartment unless switches are open.

OPTION 10—INSULATED BUS—Copper buses are to be supported on insulated bus supports and insulated for full-working voltage. (Omit uninsulated bus from base item.)

OPTION 11—INSULATED CONNECTIONS—All main primary connections inside cubicles are to be made with copper bar, insulated for full-working voltage, or with insulated cable. To insure that connections are tight before equipment is put into service, joints are to be left open for inspection and taping during installation. Material for taping these joints and the outgoing breaker terminals is to be supplied with the equipment.

OPTION 12—BARRIER BETWEEN BREAKER AND DISCONNECTING SWITCHES—Horizontal insulating barriers to be provided between oil breaker and disconnecting switches.

OPTION 13—BARRIER BETWEEN DISCONNECTING SWITCHES AND BUS—Horizontal insulating barriers are to be provided between disconnecting switches and bus. (Option applies only when hook stick operated switches are specified.)

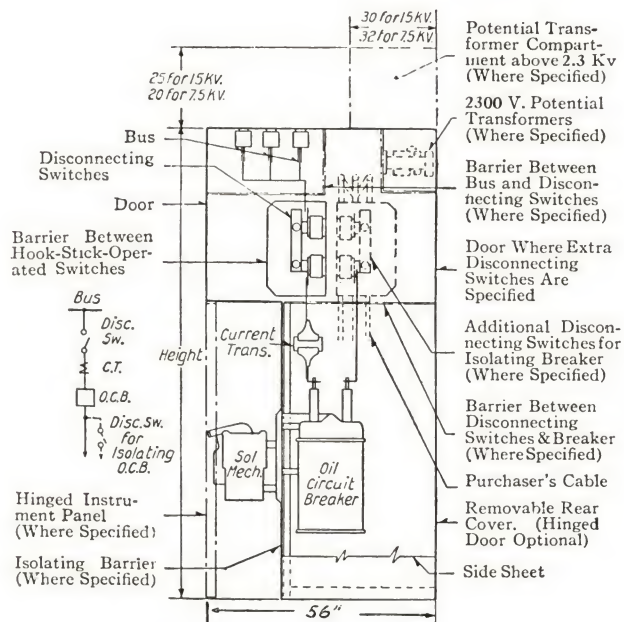
WHERE TO BUY

See your nearest Westinghouse District Office. See list on the inside back cover.

For complete information on cubicle Type Switchgear, request a copy of Descriptive Data 32-165.

RATINGS and DIMENSIONS

Type of Breaker	Breaker Rating			7500-Volt Single Bus		15000-Volt Single Bus	
	Thousands of Kv-a.	Amp.	Kv.	Dimensions in Inches		Dimensions in Inches	
				W.	H.	W.	H.
F-11	15	200	5.0	24	90	.....	.....
F-11	15	400	5.0	24	90	.....	.....
F-122	25	400	7.5	24	90	.....	.....
F-122	25	600	7.5	24	90	.....	.....
F-122	25	800	5.0	24	90	.....	.....
F-124	50	600	15.0	28	114	36	124
F-124	50	1200	7.5	28	114	.....	.....
F-124	50	2000	5.0	32	114	.....	.....
F-75	75	600	15.0	28	114	36	124
F-75	75	1200	7.5	28	114	.....	.....
F-75	75	2000	5.0	32	114	.....	.....
F-100	100	600	15.0	28	114	36	124
F-100	100	1200	15.0	28	114	36	124
F-100	100	2000	7.5	32	114	.....	.....
B-7-A	100	600	15.0	42	114	42	124
B-7-A	100	1200	15.0	42	114	42	124
B-20-B	150	600	15.0	32	114	36	124
B-20-B	150	1200	15.0	32	114	36	124
B-8-A	150	600	15.0	42	114	42	124
B-8-A	150	1200	15.0	42	114	42	124
B-24-B	250	600	15.0	32	114	36	124
B-24-B	250	1200	15.0	32	114	36	124
B-28BS	250	2000	15.0	42	124	42	134
B-10-A	250	600	15.0	52	114	52	124
B-10-A	250	1200	15.0	52	114	52	124
B-10-A	250	2000	15.0	52	114	52	124
B-28-B	500	600	15.0	42	124	42	134
B-28-B	500	1200	15.0	42	124	42	134
B-28 B	500	2000	15.0	42	124	42	134

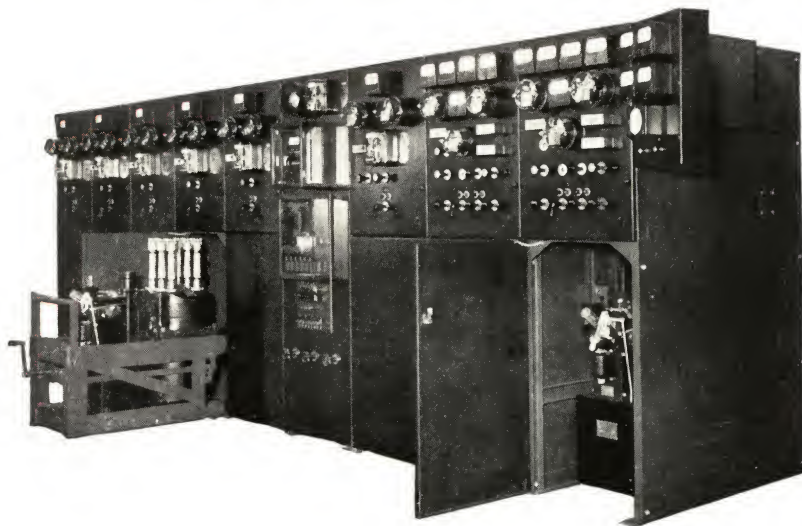


SINGLE BUS WITH EXTENDED FRONT

Note: Depth without extended front, 36". Depth with two sets of disconnecting switches, 56" for 7500-volt; 70" for 15,000-volt.



METAL-CLAD SWITCHGEAR



Metal Clad Structure with Front Enclosure with Instruments and Relays for Generator and Feeder Circuits; Self-Contained, Factory Assembled and Tested. Breaker at the right is in test position, breaker at the left shown on transfer truck is being removed for inspection.

APPLICATION

Metal-Clad Switchgear is designed to give the advantage of complete factory assembled, steel enclosed, safety type switching equipment. It can be used for distribution substations, providing control for motors, generators, incoming lines and feeders. The units are for either manually or electrically operated oil circuit breakers and may be equipped with automatic reclosing relays, if electrically operated, which will reclose the

circuit breaker a definite number of times on a predetermined schedule.

The principal advantage of metal-clad switchgear is that it is equipped with *removable* oil breakers which may be easily and quickly replaced with a spare unit. This type of switchgear is desirable where it is important that service be maintained during inspection and maintenance of the breakers.

FEATURES

SAFETY—All high voltage circuits are completely enclosed. The oil circuit breaker can be inspected only by removing it from the housing. The breaker is interlocked so that it cannot be raised or lowered without tripping it open.

ACCESSIBILITY—The breaker unit is completely accessible when removed by means of the Transfer Truck. Inspection racks are available permitting maximum accessibility for re-

moval of the tank, inspection, maintenance and checking its operation before returning it to service. Spare breakers can be used to replace those removed for maintenance since units of the same capacity are interchangeable.

SAVINGS—Installation costs are low since the equipment is shipped completely assembled. The floor space required is less than for any other type of switchgear.

HOW TO SELECT

There are two types of metal-clad switchgear, Type "F" light duty and Type "FB" heavy duty.

The two types are similar except for capacity as shown in the table and the type "FB" has insulated bus and connections in the standard base item. The buses and main connections in the Type "F" are uninsulated in the standard base item but can be insulated as covered by Option 6. The type "FB" switchgear also

includes oil tight breakers as a part of the standard base item.

THE BASE ITEM (consisting of the stationary unit with disconnecting devices, copper bus, secondary and control wiring and removable oil circuit breaker) should be selected from the table after determining the required breaker rating.

Accessories, additional equipment and arrangements not covered by the base item should be selected from the list of options.

TYPICAL SPECIFICATIONS

Switchgear shall be of the metal-clad type with removable oil circuit breakers as manufactured by Westinghouse Elec. & Mfg. Co. or approved equal. Circuit breakers shall be (1) manually (2) D.C. solenoid (3) A.C. Rectox solenoid operated.

Control voltage to be volts.

Base Item

STATIONARY UNIT—Each stationary unit or section shall include primary and secondary disconnecting devices, buses, main connections and secondary wiring. The units shall be designed so that additional units can readily be added in the future. The circuit breaker unit shall be lifted from the test, or disconnected position, to the operating position by an elevating device mounted in the stationary structure. Guide rails shall insure proper alignment of the primary contacts.

HINGED INSTRUMENT PANELS of $\frac{1}{8}$ inch cold rolled stretcher levelled steel shall be provided at the front of the units for the instruments, meters, relays and control switches. (This is provided for Type "FB" heavy duty only and accommodates a limited amount of equipment. For Type "F" light duty and for Type "FB" with a large number of relays and instruments, additional panel space will be required. This may be provided by means of extended front panels, rear panels or separate panels.)

BUS AND CONNECTION COMPARTMENTS

—The bus shall be of flat copper bars rigidly held in place within the bus compartment by means of insu-

lating supports. The buses shall be insulated and provision shall be made for insulating the joints between sections during installation. Wiping sleeves or stuffing boxes shall be supplied in the current transformer compartments for the outgoing cables. (Insulated bus and wiping sleeves or stuffing boxes are supplied as standard equipment on Type "FB" heavy duty but must be added as an additional feature on Type "F" light duty—see options 6 and 7.) The current transformers shall be mounted in the outgoing cable compartment.

PRIMARY CONTACTS—The primary circuits between the removable oil circuit breaker units and the stationary units shall be made by means of contacts mounted on the circuit breaker studs which engage with solid cylindrical contacts in the stationary structure.

SECONDARY CONTACTS—The control circuits between the stationary units and the circuit breaker units shall be made by means of automatic, self-aligning, multi-contact, plug type connectors. The receptacle shall be mounted in the stationary unit, and the plug shall be mounted on the removable circuit breaker unit. The contacts in the receptacle shall be recessed to prevent accidental short circuiting of the control circuits.

A test jumper consisting of a plug and a receptacle connected by a multi-conductor cable shall be used in operating the circuit breakers electrically after they have been lowered to the test position.

REMOVABLE BREAKER UNIT—The circuit breaker clos-



ing mechanism shall be mounted directly on the circuit breaker frame. The circuit breakers shall be equipped with devices which clearly indicate the open and closed positions.

The circuit breaker units shall be equipped with mechanical interlocks, which prevent raising or lowering the breaker in the stationary structure without tripping open the breaker.

Each removable oil circuit breaker unit shall be equipped with an exhaust valve and piping which shall be automatically connected to an exhaust header in the stationary structure when the circuit breaker unit is lifted to the operating position. (Exhaust valves and headers are standard equipment on Type "FB" heavy duty but cannot be supplied on Type "F" light duty.)

Section No. shall be equipped with a 3 pole single throw removable oil circuit breaker unit rated at. Volts Amps. KVA interrupting capacity. (Repeat for each section.)

INTERCHANGEABILITY—The removable circuit breaker units shall be assembled in jigs which accurately locate the contacts, holding devices, and interlocks. Similar jigs shall be used in the construction of the stationary units. All circuit breaker units of the same type and rating shall then run through one stationary unit, and each stationary unit shall be checked with one breaker unit to insure complete interchangeability.

GROUND BUS—The stationary units shall be equipped with a ground bus, consisting of one 2 inch x 1/4 inch copper bar, which shall be effectively grounded by the contractor. Ground contacts mounted on the removable circuit breaker unit shall make contact with a ground bar at the back of the stationary unit when the circuit breaker is elevated to the operating position.

SECONDARY AND CONTROL WIRING—The secondary wiring shall be brought to terminal blocks in a junction box at the rear of the housing where conduit and control cable may be terminated. All wiring on the unit shall be enclosed in metal conduit or sheet metal enclosures.

FACTORY TESTS—The primary and secondary connections shall be given an over-voltage test to insure that the insulation is ample for the service voltage. The units shall receive a careful inspection and check of the wiring to make sure that the equipment will function properly.

INSTALLATION—The units shall be shipped completely assembled so that the installation work will consist only of bolting the stationary units to the foundation and to each other, attaching the main and control cables to their terminal points, making the necessary bus connections, insulating the bus joints, and filling the circuit breaker tanks with oil.

Optional Equipment

(Select and Specify as Required)

OPTION 1—CURRENT TRANSFORMERS—The necessary

RATINGS and DIMENSIONS

TYPE "FB" HEAVY DUTY

Approx. Kv.-a. Interrupting Capacity	Breaker Rating		Dimensions in Inches Indoor Units			
	Voltage	Amp.	Width	†A	B	H
50000	15000	600	24	60	60	66
75000	7500	1200	24	60	60	66
75000	5000	2000	24	60	60	66
100000	15000	600	24	60	60	66
100000	15000	1200	24	60	60	66
100000	7500	2000	24	60	60	66
150000	15000	600	28	60	60	72
150000	15000	1200	28	60	60	72
250000	15000	600	28	60	60	72
250000	15000	1200	28	60	60	72
250000	15000	2000	36	68	68	82
500000	15000	600	36	68	68	82
500000	15000	1200	36	68	68	82
500000	15000	2000	36	68	68	82

TYPE "F" LIGHT DUTY

Approx. Kv.-a. Interrupting Capacity	Breaker Rating		Dimensions in Inches Indoor Units			
	Voltage	Amp.	Width	†A	B	H
25000	5000	400	20	36	38	66
	5000	600	20	36	38	66
	5000	800	20	36	38	66
50000	5000	600	20	36	38	66
	5000	1200	20	36	38	66
	5000	2000	24	60	60	66

†Minimum aisle space.
Dimensions are for reference only. For official dimensions apply to nearest district office

current transformers of required ratio, single or double secondary, shall be supplied.

OPTION 2—INSTRUMENTS AND RELAYS—The necessary instruments and relays, and control, instrument and test switches, as indicated in the plans or specified herein shall be supplied. (Specify requirements.)

OPTION 3—POTENTIAL TRANSFORMER COMPARTMENTS—The potential transformers, where required, shall be mounted in separate metal enclosed compartments located above the bus compartment. The compartments shall enclose the transformers, primary fuse blocks and fuses, and the current limiting resistors. Hinged doors at the front of the compartments shall allow access to the potential transformer primary fuses. One compartment shall be supplied for each set of transformers.

OPTION 4—TRANSFER TRUCK—A transfer truck shall be provided for use in removing the circuit breaker units from the stationary units and in moving them about the station. The truck shall be equipped with a lifting device, having sufficient travel to permit setting the circuit breaker units on the floor. The front wheels of the truck shall be swiveled. One truck shall be provided for each unit of a different physical size.

OPTION 5—INSPECTION RACK—An inspection rack shall be provided consisting of a self-supporting frame with a built-in elevating device, control wiring, control conduit, electrically trip-free control relay, and a control switch for operating the breaker electrically. The elevating device shall have sufficient travel to permit the use of the inspection rack in removing the tanks from the oil circuit breakers.

The transfer truck shall be so designed that it can be used in connection with the inspection rack for removing the tanks from a circuit breaker which has been placed in the inspection rack.

OPTION 6—INSULATED BUS AND CONNECTIONS—The bus and connections shall be insulated and provision shall be made for insulating the joints between sections during installation. (This option applies to Type "F" only. Insulated bus is included as part of the base item for Type "FB".)

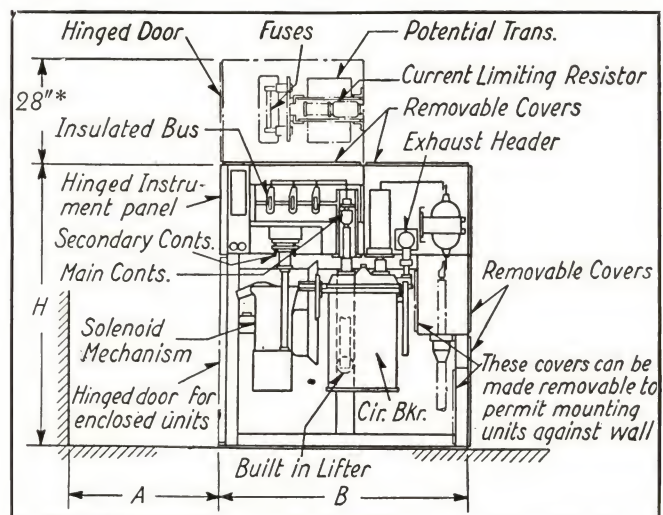
OPTION 7—WIPING SLEEVES—Wiping sleeves or stuffing boxes shall be supplied in the current transformer compartments for the outgoing cables. (This option applies to Type "F" only. Wiping sleeves are supplied as a part of the standard base item for Type "FB".)

OPTION 8—HINGED FRONT DOORS—Provide Hinged Front Doors for enclosing front of breaker compartment. (Base item for both Type "FB" and Type "F" has open front on the breaker compartment. Addition of these doors makes unit completely enclosed.) For Type "F," front enclosure increases depth 12" for hand operated 50,000 KVA breakers and 8" for electrically operated 50,000 KVA and all 25,000 KVA breakers.

WHERE TO BUY

See your nearest Westinghouse District Office. See list on the inside back cover.

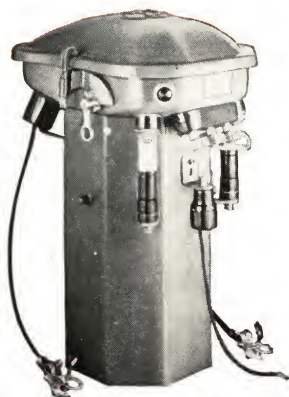
For complete information on metal-clad Switchgear request a copy of Descriptive Data 32-150 and 32-160.



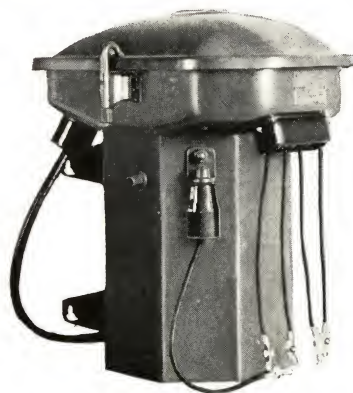
*Height of potential transformer compartment can be reduced to 18" for 2300 volt units.



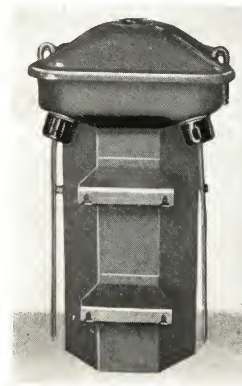
DISTRIBUTION TRANSFORMERS



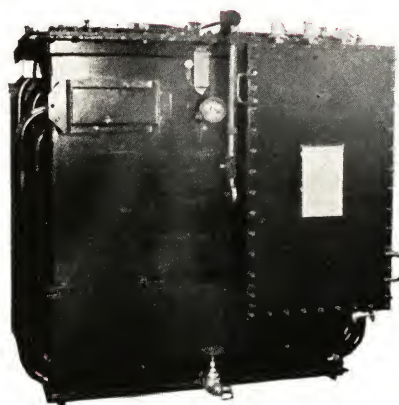
CSP TRANSFORMER
(Completely Self-protected)



SP TRANSFORMER
(Surge protected)



TYPE S TRANSFORMER
(Conventional)



NETWORK
TRANSFORMER



TYPE SM (Subway)
TRANSFORMER

APPLICATION

It is often desirable and in some cases necessary for the owner of a building or construction project to purchase power at *High Voltages*. This requires the use of distribution transformers of various types and capacities depending upon the type of secondary load and the proposed location of the transformers.

Westinghouse Distribution Transformers are built in six different types for different applications.

1. "S," "SK," "SS," "SL" CONVENTIONAL TRANSFORMERS are for indoor mounting in fire-proof vaults or for outdoor mounting. Lightning protection is provided by separate arresters and cutouts.

2. "SP" SURGE PROTECTED DISTRIBUTION TRANSFORMERS are used for Urban, Suburban or Rural Distribution

lines and are for outdoor mounting where built-in lightning protection only is desired.

3. "CSP" COMPLETELY SELF PROTECTING TRANSFORMERS are used for Urban, Suburban or Rural Distribution lines and are for outdoor mounting where Built-In Lightning and overload protection is desired.

4. INERTEEN FILLED TRANSFORMERS are used for indoor applications and eliminate the necessity for fire-proof vaults.

5. "SM" SUBWAY TRANSFORMERS are used for underground mounting in manholes where dampness is prevalent.

6. NETWORK TRANSFORMERS are used on low-voltage network systems in heavily loaded areas of large cities or buildings. These transformers can be supplied in either non-submersible or submersible water-tight designs.

FEATURES

1. Conventional Distribution Transformers

REMOVABLE BUSHINGS—Oil-proof removable type bushings are used on both the high and low voltage sides.

SMALL DIMENSIONS and light weight reduce handling costs and simplify mounting.

OIL-TIGHT case and cover permits shipping and moving transformers when filled with oil.

2. "SP" Surge Protected Distribution Transformers

LIGHTNING PROTECTION—Protective De-ion gaps form an integral part of the transformer design and assure surge-proof three-point protection.

3. "CSP" Completely Self-Protecting Transformers

LIGHTNING PROTECTION is provided by built-in De-ion gaps which are able to discharge direct lightning strokes without damage.

OVERLOAD PROTECTION is provided by an internally mounted thermal breaker which protects against cumulative overloads and short circuits.

HIGH VOLTAGE PROTECTIVE LINKS are built into the transformer to clear the transformer from the line in case of winding faults.

ADVANCE WARNING of excessive copper temperatures is given by an indicating lamp so condition can be corrected.

NO SEPARATELY MOUNTED PROTECTIVE DEVICES REQUIRED. Complete protection is built into the transformer.

4. Inerteen Filled Transformers

NON-INFLAMMABLE Inerteen is non-explosive and is approved by the Underwriters. (See their Bulletin No. MH-2689)

ELIMINATES FIRE-PROOF VAULTS or protective housing necessary for oil filled transformers.

FLEXIBILITY—Inerteen filled transformers of the conventional, manhole, or network designs are available in all standard commercial ratings.

5. "SM" Subway Distribution Transformers

WATER-PROOF—"SM" transformers are water-tight and of submersible design. All materials, finish, and construction have been selected to protect the exposed parts against moisture.

6. Network Transformers

SAFETY is provided through the use of electrical and mechanical interlocks which make it impossible to operate the grounding switch or the tap changer when the transformer is energized.

CONVENIENCE in installation and reliability in operation have been given paramount consideration in these transformers.



HOW TO SELECT

Transformer types should be determined by the proposed application and location. Standard kv-a. ratings, voltages, taps,

etc., can be selected from the tables shown below for the proper system voltage.

DIMENSIONS

Dimensions and weights are given in Westinghouse Catalog 46-000.

TYPICAL SPECIFICATIONS

APPLICATION Select One	The {lighting power}
PHASE Select One	{one two three} phase filled with
INSULATING MEDIUM Select One	{oil Inerteen} for transforming from .....volts...../phase.....cycle..... wire on the high voltage side to.....volts.....phase.....cycle.....wires on the low side
TYPE Select One	Transformers shall be of the {conventional surge protected completely self-protecting subway network} type shall be furnished and in- stalled where shown on the plans and of the capacities noted
TAPS Select One	{2-5 % 4-2 1/2 %} Full capacity taps shall be provided on the high voltage winding.....taps above normal (number) .....taps below normal (number)
LOCATION Select One	Transformers shall be suitable for {outdoor indoor vault subway} service and shall be arranged for
MOUNTING Select One	{floor wall pole} mounting

BUSHINGS—High voltage bushings shall be (stud, wiping sleeve, pothead) type, (cover, side, pocket) mounted. Low voltage bushings shall be (stud, wiping sleeve, pothead) type, (cover, side, pocket) mounted. All bushings shall have suitable gaskets to provide a tight fit.

GUARANTEE—Bidders shall state and guarantee the following—
(a) Efficiencies at $\frac{1}{2}$, $\frac{3}{4}$ and full load at unity power factor and 75 deg. C.
(b) No load loss
(c) Total full load loss

- (d) Regulation at 100% and 80% power factor
(e) The net and shipping weights
(f) Gallons of liquid required per transformer
(g) The limiting dimensions of each transformer

TESTING—Sufficient tests shall be made by the manufacturer to see that the guarantees will be met. Testing shall conform to the A.I.E.E. Transformer Standards and transformers must meet the A.I.E.E. acceptance tests.

WINDINGS—The individual high voltage and low voltage coils shall be wound on separately formed barriers in order to facilitate removal of the coils in case of repairs.

The windings shall consist of copper coils, suitably insulated, thoroughly dried and vacuum treated.

CORE—The core shall be manufactured of high grade non-ageing sheet steel laminations, properly annealed, treated and insulated from each other in accordance with the latest approved practice.

TANK AND COVER—The tanks shall be of welded steel construction free from leaks and seepage.

The surfaces of the tank and cover shall be thoroughly cleaned of all dirt, grease and other impurities, painted with at least two coats of paint which shall not affect or be affected by the cooling and insulating liquid.

A gasket shall be placed between tank and cover to make a tight joint.

ACCESSORIES—Transformers shall be equipped with the following accessories.

- Select accessories desired
- 1—Drain plug
 - 2—Diagram name plate
 - 3—Dial type indicating thermometer (with, without) alarm contacts
 - 4—Tap changing switch to permit changing connections in the high voltage winding from the outside of the tank. (For operation only when transformer is disconnected.)
 - 5—Sampling valve
 - 6—Fluid gauge
 - 7—Top and bottom filter press connections

Transformers shall meet the latest requirements of the A.I.E.E. and shall be Westinghouse Type.....or approved equal.

WHERE TO BUY

See your nearest Westinghouse District Office or Agent Jobber listed on the inside back cover.

For complete information request a copy of Westinghouse Catalog 46-000.

NEMA STANDARDS — Single-phase Distribution Transformers

Sizes 500 Kv-a. and Below—Standard Types—Oil-Immersed—Self-Cooled

Standard Kv-a. Ratings at 55 Deg. C. Rise 1.5, 2.5, 3, 5, 7.5, 10, 15, 25, 37.5, 50, 75, 100, 150, 200, 250, 333, 500

Nominal System Voltage	STANDARD SIZES, VOLTAGE RATINGS, AND TAPS OF TRANSFORMERS FOR THE VARIOUS SYSTEM VOLTAGES					
	Standard Kv-a. Sizes For Each Voltage Class	Rated Voltage—High Voltage	HIGH VOLTAGE TAPS		Rated Voltage—Low Voltage	
			Full Capacity	Reduced Capacity		
440	1.5, 3 to 200 incl.	480	456	432	120/240	
550	1.5, 3 to 200 incl.	600	570	540	120/240	
2,300 and 4,000	1.5, 3 to 50 incl.	{ 2,400/4,160 Y 2,500/4,330 Y	.....	.....	120/240	240/480 600
	75 to 500 incl.	{ 2,400/4,160 Y 2,500/4,330 Y	2,280 2,375	2,160 2,250	120/240 125/250	240/480 600
4,600	1.5, 3 to 100 incl.	{ 2,400/4,800 2,500/5,000	.....	.....	120/240 125/250	240/480 600
	150 to 500 incl.	{ 2,400/4,800 2,500/5,000	2,280 4,560 2,375 4,750	2,160 4,320 2,250 4,500	120/240 125/250	240/480 600
6,600 and 11,000	1.5, 3 to 500 incl.	{ 6,900/11,950 Y 7,200/12,470 Y	6,585 6,875	6,275 6,545	115/230 120/240	230/460 575 240/480 600
	5 to 500 incl.	6,600/11,430 Y	6,270	5,940	2,300	
	2.5, 5, 10 to 500 incl.	{ 11,500 12,000	10,925 11,400	10,350 10,800	115/230 120/240	230/460 575 240/480 600
	5, 10 to 500 incl.	11,000	10,450	9,900	2300/4000 Y	
13,200	1.5, 3 to 500 incl.	{ 7,620/13,200 Y 7,940/13,750 Y	7,240 7,545	6,860 7,145	120/240 125/250	240/480 600
	5 to 500 incl.	7,620/13,200 Y	7,240	6,860	.....	..... 2400
	2.5, 5, 10 to 500 incl.	13,200 13,750	12,540 13,060	11,880 12,375	120/240 125/250	240/480 600
	5, 10 to 500 incl.	13,200	12,540	11,880	2400/4160 Y.....	



LOW VOLTAGE DISTRIBUTION SWITCHBOARDS



"De-ion" Circuit Breaker
Distribution Switchboard with
3000 ampere Dead Front Main
Circuit Breaker

APPLICATION

Circuit breaker distribution switchboards are used to distribute secondary electrical energy for power and lighting circuits of 600 volts AC or 250 volts DC. They are designed to give fuseless protection to all circuits.

AB "De-ion" circuit breakers are used on all circuits up to and including 600 amperes, 600 volts AC or 250 volts DC. Type CL back of board, front operated air circuit breakers are used above 600 amperes.

FEATURES

LOW INSTALLATION COST—Steel construction and simple design make possible safe transportation, easy assembly, and economical installation.

SAFETY—Metal built dead-front safety type construction. No live parts exposed on front of the board.

COMPACT CONSTRUCTION—Takes less space. Makes a fine appearance and can accommodate meter equipment.

SAVINGS—Space economy due to compact design of breaker saves up to $\frac{1}{3}$ or $\frac{1}{2}$ the usual board space.

HOW TO SELECT

Determine the number and current carrying capacity of the branch feeders required. From page 37 select the proper breakers to give suitable conductor protection.

1—If circuits are to feed motors, the proper rating of branch circuit breaker should be selected from the table page 36.

2—For all circuits other than motor circuits, it is essential that the branch circuit wire size be known so that a breaker of the proper capacity is used and not one of a capacity larger than the wire size it is protecting. Nofuze De-ion Breakers are rated by ampere capacities corresponding to the current carrying capacity of commercial rubber covered wire.

3—The actual load on the circuit should be given full consideration, so that in case an extra heavy wire is being used to avoid voltage drop, a breaker larger than necessary to carry the load is not used. For instance, a No. 00 (150 ampere) wire might be used to avoid voltage drop when under ordinary circumstances a No. 1 wire would be satisfactory, since the actual load being carried is not over 100 amperes. In this case a 100-ampere breaker would be satisfactory as it would afford full protection to the wire used, and at the same time be able to carry the load.

Main breaker sizes depend upon the connected load and the portion of it expected to be 'on' at any one time.

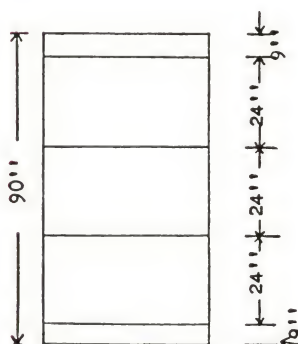
DIMENSIONS

MINIMUM PANEL REQUIREMENTS

For 600 V., A.C. or less—250 V., D.C.

Thermal Type Circuit Breakers MOUNTED ON STEEL PANELS ONLY

Table A



Frame Capacity of Breaker	2 Pole		3 Pole	
	Wide	High	Wide	High
50 A.	3 1/2"	12"	5 1/2"	12"
100 A.	7"	12"	10"	12"
225 A.	7"	18"	10"	18"
400 A.	10"	24"	10"	24"
600 A.	10"	24"	10"	24"

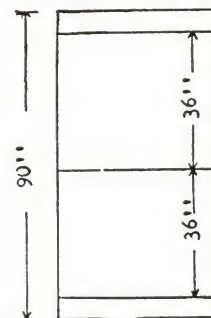
The 9" sections may be reduced when overall height of board is less than 90". The 36" and 24" high sections for mounting breakers are standard and cannot be reduced.

There are only two widths of panels used for mounting thermal type trip breakers—these are 12" and 16".

The 12" widths are for mounting three pole breakers of all sizes up to 225 ampere frame, and the 600 ampere two pole frame, either with or without risers. The 12" widths are to be used for 600 ampere three pole breakers only when risers are used. The 12" widths will permit mounting two 50

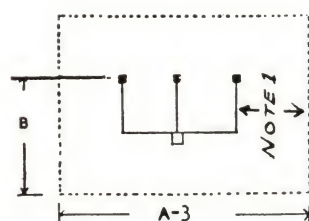
ampere three pole breakers or only one each of the higher capacities in a horizontal row.

The 16" widths are for mounting two-pole, 50 ampere, 100 ampere, and 225 ampere frame breakers. It will permit four of the 50 ampere frames in one horizontal row and two of the 100 ampere or 225 ampere two-pole frames in one horizontal row. It must be used for the three-pole, 600 ampere size when supplied without risers to provide sufficient cable clearance. Only one 600 ampere breaker can be mounted in a horizontal row.



Space Required on Switchboard for Air Circuit Breakers Other Than Thermal Type

Table B



A2 = Double Pole A3 = Three Pole	Dead Front 2 and 3 Pole Dimensions (Steel Panels Only)			Add to Height B for Reverse Current	Add to Width A for Reverse Current	Add to Width A for Under V. or Shunt T.	Add to Height B for Elec. Operate
	Amperes	A2	A3	B			
	800	24	28	30	3	3	17
	1200-1600	24	32	30	8	3	20
	2000-3000	32	44	68	8	3	27
	4000	32	44	68	6	1	27

Note (1) The minimum distance between width dimensions and the edge of the panel is 2 inches.

Space Required on Switchboards for Instruments, etc.

- (1) Increase the actual dimensions of instruments or any other equipment not specifically mentioned by $1\frac{1}{2}$ inches in both width and height.
- (2) The distance to the edge of the panel for this equipment shall not be less than 2 inches.
- (3) The space required by rheostats shall be the space actually required on the back of the panel.

It will be seen from the illustrations that the front of the panel is sectionalized. For a standard 90-inch high panel, sections nine inches in height are usually provided at the top and bottom in order that the breakers may be located at convenient heights for operation and to provide space for meters or instruments at the top when required. The intermediate sections which cover the breakers may be either two sections, 36" high, or three sections 24" high, depending upon the breakers to be used.

For "De-ion" breakers two widths of panel fronts are provided, 12 inches and 16 inches.

The 9" sections may be reduced when overall height of board is less than 90". The 36" and 24" high sections for mounting breakers are standard and cannot be reduced.

There are only two widths of panels used for mounting thermal trip breakers—these are 12" and 16".

The 12" widths are for mounting three pole breakers of all sizes up to 225 ampere frame, and the 500 ampere two-pole frame, either with or without risers. The 12" widths are to be used for 600 ampere three-pole breakers only when risers are used. The 12" widths will permit mounting two 50 ampere three-pole breakers or only one each of the higher capacities in a horizontal row.

The 16" widths are for mounting two-pole, 50 ampere, 100 ampere, and 225 ampere frame breakers. It will permit four of the 50 ampere frames in one horizontal row and two of the 100 ampere or 225 ampere two-pole frames in one horizontal row. It must be used for the three-pole 600 ampere size when supplied without risers to provide sufficient cable clearance. Only one 600 ampere breaker can be mounted in a horizontal row.

TYPICAL SPECIFICATIONS

Switchboard shall be the dead front safety type consisting of panels and circuit breakers of the number shown on the drawings. The construction shall consist of a structural or formed steel frame carefully braced and welded into a rigid structure which shall maintain its alignment and not be damaged in shipment or erection or by stresses resulting from short circuits. The frame shall be completely enclosed on front, sides, and back with sheet steel plates not less than $\frac{1}{8}$ -inch thick, except that removable front sections not supporting breakers may be $\frac{1}{16}$ -inch thick.

The front surfaces shall be flanged sheet steel panels rolled with $\frac{1}{4}$ -inch radius on inside edges. Butt joints on front surfaces will not be permitted. Electrical interconnections between compartments (when required) shall be made through insulating barriers. For breaker 600-A or less the front plate shall be held in place by two or more oral head screws.

The air circuit breakers above 600-A capacity shall be mounted on a frame located sufficiently back of a swinging front door to provide, together with barriers, adequate electrical clearance. Necessary louvers shall be provided on the back panels and/or doors of the enclosure to provide proper ventilation.

The closing handle for breakers over 600-A capacity shall be of the rotary type removable only in the trip position. The doors shall be arranged to permit opening after the handle is removed and door latch thumb screws released. A manual trip button shall be provided projecting through the swinging door panel. The position of the circuit breaker shall be indicated by a suitable colored semaphore directly in the rear of the door and visible through an opening provided.

Plates for front panels shall be stretcher leveled steel. A pull box of the same type of construction not less than three feet in depth shall be provided at the top of each switchboard which

shall match the switchboard in dimension and finish. Bottom of pull box shall be slate or asbestos board and cables to circuit breaker studs dropped vertically through individual openings in bottom to their respective studs. The entire unit shall be securely bolted to channel iron sills grouted into the floor. Each entire unit shall be painted two coats both inside and out, the first being a rust-resisting coat and the second a dull black. The front shall be finished to present a dull gloss appearance. Surfaces damaged or scratched during erection shall be refinished and the whole unit rubbed down with an approved polish. Switchboard shall be sectionalized vertically and each section shall be readily removable to permit access to the circuit breakers.

CIRCUIT BREAKERS—Circuit breakers shall be 1, 2, or 3-pole with trip elements calibrated in wire size capacities as shown on drawings. Circuit breakers 600 amperes and less shall be of the "De-ion" thermal type (see Spec. A, page 00). Air Circuit breakers above 600 amperes shall be of the back of board mounted front operated type (see Spec. B, page 00).

BUS SYSTEM—Buses on switchboard shall be of hard drawn copper or 98 per cent conductivity. Connections shall be bolted and laminations interleaved to secure maximum contact areas. All contact surfaces shall be clean and bright when assembled. All laminations shall have a $\frac{1}{4}$ -inch space between them. All buses and circuit breaker stub connections shall be of such size as to limit the temperature rise to 30 degrees centigrade when carrying full-load current at room temperature, but not to exceed a current density of 1000 amperes per square inch. Buses shall be suitably arranged for single phase 3 wire, 3 phase 3 wire, or 3 phase 4 wire distribution as shown on drawings or called for in the specification. The neutral bus shall be separately grounded by an approved grounding conductor. This ground connection shall be entirely separate from all other ground connections

WHERE TO BUY

See your nearest Westinghouse District Office or agent jobber. For further information request Catalog 29-000.

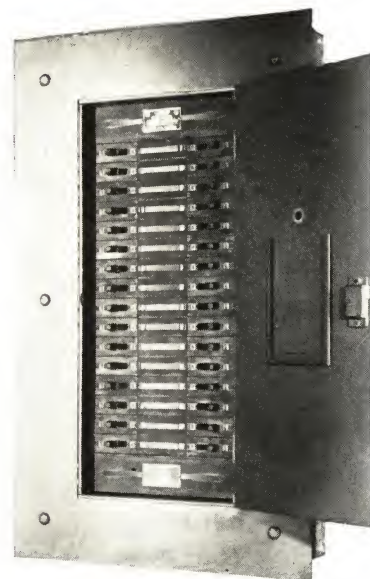
A list of offices and agent jobbers is shown on inside the back cover.



NOFUZE PANELBOARDS



NOFUZE CONVERTIBLE DISTRIBUTION PANELBOARD



LIGHTING BRANCH CIRCUIT PANELBOARD



MODERNISTIC FLUSH TYPE LOCK

APPLICATION

Nofuze panelboards are used for the distribution of secondary electrical energy for power and lighting circuits of 600 volts a-c. or 250 volts d-c. and below with capacities from 15 to 600 amperes, one, two and three poles.

There are three types of Nofuze panelboards (not including the Multi-Breaker Panelboard):

- 1—Convertible distribution panelboards
- 2—Low capacity distribution panelboards
- 3—Lighting branch circuit panelboards

CONVERTIBLE (OR HIGH CAPACITY PANELBOARDS) are available with two or three pole main and branch breakers in capacities from 15 to 600 amperes.

LOW CAPACITY DISTRIBUTION PANELBOARDS are designed for low capacity power and lighting applications in which the capacity of any branch circuit need not exceed 50 amperes, 230 volts a-c. although one feeder up to 225 ampere capacity may be supplied. Main lugs up to 400 ampere capacity or main breakers up to 225 ampere capacity can be supplied.

NOFUZE LIGHTING BRANCH CIRCUIT BREAKERS are used for protecting and controlling branch lighting circuits. They are available in ratings from 15-50 ampere, 230 volt a-c. or 125 volt d-c. with from 4 to 42 single pole branch breakers and from 4 to 20 two-pole branch breakers, either with or without main breakers.

FEATURES

ELIMINATES FUSES AND SWITCHES—The use of Nofuze "De-ion" circuit breakers in mains and branches gives full circuit protection and makes the use of switches and fuses unnecessary.

ATTRACTIVE APPEARANCE—Cabinet Fronts finished in an attractive olive green Duco. The modernistic chromium plated combination lock and catch, and flush type hinges adds to the finished appearance of the front.

HOW TO SELECT

Before laying out a panel, all circuit capacities must be carefully checked for the following three requirements:

- 1—If circuits are to feed motors, the proper rating of branch circuit breaker should be selected from the table page 36.
- 2—For all circuits other than motor circuits, it is essential that the branch circuit wire size be known so that a breaker of the proper capacity is used and not one of a capacity larger than the wire size it is protecting. Nofuze De-ion Breakers are rated by ampere capacities corresponding to the current carrying capacity of commercial rubber covered wire. See table, page 37.
- 3—The actual load on the circuit should be given full consideration, so that in case an extra heavy wire is being used to avoid voltage drop, a breaker larger than necessary to carry the

load is not used. For instance, a No. 00 (150 ampere) wire might be used to avoid voltage drop when under ordinary circumstances a No. 1 wire would be satisfactory, since the actual load being carried is not over 100 amperes. In this case a 100-ampere breaker would be satisfactory as it would afford full protection to the wire being used, and at the same be able to carry the load.

LIGHTING BRANCH CIRCUIT PANELBOARDS may be selected from the tables on page 14.

NARROW OR LOW CAPACITY DISTRIBUTION PANELBOARDS may be selected from the tables on page 15.

CONVERTIBLE OR HIGH CAPACITY DISTRIBUTION PANELBOARDS are built to order according to requirements. To determine the layout for specific requirements, it is necessary to determine the number of "X" areas as explained below.

DIMENSIONS

Dimensions for LIGHTING BRANCH CIRCUIT PANELBOARDS and LOW CAPACITY DISTRIBUTION PANELBOARD CABINETS are 20 inches wide, 5 $\frac{3}{4}$ inches deep and of the height given in the tables on page 14 and page 15.

CONVERTIBLE OR HIGH CAPACITY PANELBOARDS: Determine the number of "X" areas required for the complete panel, and then the dimensions may be obtained from the tables on page 15.

TO DETERMINE THE NUMBER OF X AREAS—In the construction of the panelboards, three types of sections are employed. These are designated as "A," "B," and "C" sections. The "A" sections

accommodate the 50 and 100-ampere frame breakers and have a length equal to one-half the width of the panel (two rows of "A" sections being necessary to make up the complete width). The "B" section extends the full width of the panel and accommodates the 225-ampere frame breaker, as well as the neutral and main lug sections. The "C" sections are 2 inches longer (the horizontal dimension when assembled) than the "B" sections, but otherwise are the same and accommodate the 400 and 600-ampere frame breakers. All sections, however, can be assembled in the same panel.

In order to facilitate laying out the panel, it has been split up into units of area called "X" which are one-half the panel width

and $1\frac{3}{8}$ inches high. Each branch circuit, or frame size, is a multiple of "X" units. Diagram shows the correct number of "X" units per section or frame size. For instance, a 3-pole, 100 ampere frame breaker requires a space of 6X. This being an "A" section means that it occupies one-half the width of the panel and is $8\frac{1}{4}$ inches high. A 3-pole, 225 ampere frame breaker occupies a space of 12 X but is a type "B" section. Therefore, it is only $8\frac{1}{4}$ inches high, since it extends the full width of the panel.

The neutral section, when the panel has main lugs only, is always placed at the opposite end of the panel from the main lugs and its main feed lug is brought to the main lug section. Under these conditions the neutral section occupies 6 X space when the capacity of its largest branch lug is not over 400 amperes.

When a neutral section is required on panels having a main breaker, it is placed at the same end of the panel as the main breaker. In such cases its space requirement should be the same as a main lug section of capacity equal to main breaker capacity.

TYPICAL SPECIFICATIONS

CIRCUIT BREAKERS—(See page 16, Circuit breaker specification A.)

PANELBOARDS—Furnish and install where shown on plans or specified, panelboards mounted in enclosing cabinets on which shall be mounted equipment, as required, specified or shown in the drawings.

Panelboards shall be of the dead front type and shall be equipped with automatic branch circuit breakers for each branch circuit. Automatic branch circuit breakers shall conform to the detailed specifications as hereinafter specified. Number of branch circuits shall be as indicated on plans, specified or required by the number of branch circuits which will be connected to the panel.

Panelboards shall be of the unit type construction so designed that individual units can be removed from the front of the panel without disturbing adjacent units after first removing the trim.

Current carrying parts exclusive of circuit breakers shall be based on a maximum density of 1000 amp. per square inch.

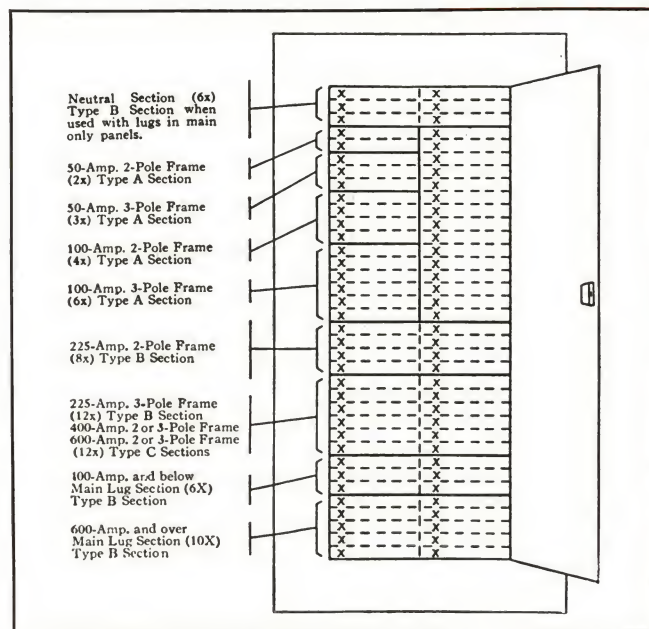
Panelboards shall have bus bars and branch circuits designed to suit the system and voltage.

CONVERTIBLE OR HIGH CAPACITY DISTRIBUTION PANELBOARDS

PANEL AND BOX DIMENSION DATA

All Inside Dimensions, in Inches

Total "X" Panel Space (obtained from diagram above)	Panel Only Height, Inches	Main Bus Capacity	
		100, 200 and 400-Ampere Box Height Inches	600, 800 and 1000-Ampere Box Height Inches
24X	16½	29½	35
25X to 32X	22	35	40½
33X to 40X	27½	40½	46
41X to 48X	33	46	51½
49X to 56X	38½	51½	57
57X to 64X	44	57	62½
65X to 72X	49½	62½	68
73X to 80X	55	68	73½
81X to 88X	60½	73½	79
89X to 96X	66	79	84½
LARGEST BREAKER IN THE PANEL		Box Width	Box Depth
FOR 50, 100 AND 225-AMPERE FRAME SIZE 2 AND 3-POLE BREAKERS		30 Inches	8 Inches
FOR 226 TO 400-AMPERE, 2 AND 3-POLE BREAKERS—With or Without 50, 100 and 225-Ampere Frame Sizes		35 Inches	10 Inches
FOR 401 TO 600-AMPERE, 2 AND 3-POLE BREAKERS—With or Without 50, 100, 225 or 400-Ampere Frame Sizes		40 Inches	10 Inches



LAYOUT DIAGRAM USED WITH NOFUZE CONVERTIBLE
DISTRIBUTION PANELBOARDS

Bus bars shall run up the center of the panel and shall have connected thereto the various branch circuits.

Unless otherwise specified, bus bars for each panelboard shall be equipped with main lugs only, the capacity of which shall be as required and shown on the plans. Where main protection is required automatic circuit breakers shall be used.

All current carrying parts exclusive of circuit breakers shall be of copper firmly fastened to the panelboard and arranged so as not to be displaced during installation.

Where several panelboards are fed by one feeder, solid through connections shall be made in the gutters as required.

Unless otherwise specified all panelboards shall be mounted in enclosing cabinets consisting of a code gauge, sheet steel box with trim and door. The box shall be manufactured from commercial galvanized sheet steel with corners lapped and riveted or by other approved methods. The trim shall be manufactured from one piece of full finish sheet steel (not galvanized).

Cabinets shall be of sufficient size to allow a gutter space of at least 4" on all sides around lighting panelboards.

Trim shall be fastened to cabinet by means of approved adjustable clamps.

Doors and trims of enclosing cabinet for lighting panelboards shall be painted with two coats of paint, the first being a primary coat and the second a finish coat of olive green lacquer.

All trims shall have door equipped with chrome plated flush type combination lock and catch, two keys being supplied with each lock. Doors over 48" in height shall be equipped with a chrome plated vault handle and 3 point catch with built-in lock using same key as flush locks and arranged to fasten door at top, bottom and center.

A directory holder with metal frame shall be furnished and installed upon the inside of the door of each cabinet.

All panelboards shall be built in accordance with the requirements of Underwriters' Laboratories specifications and recommendations of NEMA, and shall bear the Underwriters' Inspection Label.

Panelboards shall be as manufactured by the Westinghouse Electric & Manufacturing Company or approved equal.

WHERE TO BUY

See nearest Westinghouse Office or agent jobber shown on back cover. For further information request Catalog 29-000.



NOFUZE LIGHTING BRANCH CIRCUIT PANELBOARDS

Number of Circuits	Main Amps.	Types NA1B-3L and NA1B-3AB—Single Pole—Solid Neutral Mains 125/250 Volt, 3 Wire—Branches 125 Volt, 2 Wire			Types NA1B-4L and NA1B-4AB—Single Post—Solid Neutral Mains 125/250 Volt, 3-Phase, 4 Wire Branches 125 Volt, 2-Wire		
		Panel, box and front Cat. No.	Height of Box I. d., In.	Approx. Ship. Wt., Lb.	Panel, box and front Cat. No.	Height of Box I. d., In.	Approx. Ship. Wt., Lb.
LUGS IN MAINS							
4	50	NA1B04-3L050	16¼	75	NA1B04-4L050	16¼	75
6	50	NA1B06-3L050	19	86	NA1B06-4L050	19	86
8	50	NA1B08-3L050	19	95	NA1B08-4L050	19	95
10	50	NA1B10-3L050	21¾	101	NA1B10-4L050	21 ¾	101
12	100	NA1B12-3L100	21¾	105	NA1B12-4L050	21 ¾	105
14	100	NA1B14-3L100	24½	112	NA1B14-4L050	24 ½	112
16	100	NA1B16-3L100	24½	120	NA1B16-4L100	24 ½	120
18	100	NA1B18-3L100	27¼	127	NA1B18-4L100	27 ¼	127
20	100	NA1B20-3L100	27¼	135	NA1B20-4L100	27 ¼	135
22	100	NA1B22-3L100	30	142	NA1B22-4L100	30	142
24	100	NA1B24-3L100	30	150	NA1B24-4L100	30	150
26	100	NA1B26-3L100	32¾	155	NA1B26-4L100	32 ¾	155
28	100	NA1B28-3L100	32¾	160	NA1B28-4L100	32 ¾	160
30	100	NA1B30-3L100	35½	179	NA1B30-4L100	35 ½	179
32	100	NA1B32-3L100	35½	180	NA1B32-4L100	35 ½	180
34	200	NA1B34-3L200	38¼	200	NA1B34-4L100	38 ¼	200
36	200	NA1B36-3L200	38¼	215	NA1B36-4L100	38 ¼	215
38	200	NA1B38-3L200	41	222	NA1B38-4L100	41	222
40	200	NA1B40-3L200	41	230	NA1B40-4L100	41	230
42	200	NA1B42-3L200	43¾	238	NA1B42-4L100	43 ¾	238

MAIN NOFUZE CIRCUIT BREAKER

4	50	NA1B04-3AB050	21 $\frac{3}{4}$	105	NA1B04-4AB050	21 $\frac{3}{4}$	105
6	50	NA1B06-3AB050	24 $\frac{1}{2}$	112	NA1B06-4AB050	24 $\frac{1}{2}$	112
8	50	NA1B08-3AB050	24 $\frac{1}{2}$	125	NA1B08-4AB050	24 $\frac{1}{2}$	120
10	50	NA1B10-3AB050	27 $\frac{1}{4}$	130	NA1B10-4AB050	27 $\frac{1}{4}$	133
12	100	NA1B12-3AB100	32 $\frac{3}{4}$	140	NA1B12-4AB050	27 $\frac{1}{4}$	145
14	100	NA1B14-3AB100	35 $\frac{1}{2}$	145	NA1B14-4AB050	30	150
16	100	NA1B16-3AB100	35 $\frac{1}{2}$	150	NA1B16-4AB100	35 $\frac{1}{2}$	155
18	100	NA1B18-3AB100	38 $\frac{1}{4}$	160	NA1B18-4AB100	38 $\frac{1}{4}$	165
20	100	NA1B20-3AB100	38 $\frac{1}{4}$	170	NA1B20-4AB100	38 $\frac{1}{4}$	175
22	100	NA1B22-3AB100	41	182	NA1B22-4AB100	41	187
24	100	NA1B24-3AB100	41	195	NA1B24-4AB100	41	200
26	100	NA1B26-3AB100	43 $\frac{3}{4}$	202	NA1B26-4AB100	43 $\frac{3}{4}$	207
28	100	NA1B28-3AB100	43 $\frac{3}{4}$	210	NA1B28-4AB100	43 $\frac{3}{4}$	215
30	100	NA1B30-3AB100	46 $\frac{1}{2}$	217	NA1B30-4AB100	46 $\frac{1}{2}$	222
32	100	NA1B32-3AB100	46 $\frac{1}{2}$	225	NA1B32-4AB100	46 $\frac{1}{2}$	230
34	200	NA1B34-3AB200	54 $\frac{3}{4}$	255	NA1B34-4AB100	49 $\frac{1}{4}$	243
36	200	NA1B36-3AB200	54 $\frac{3}{4}$	275	NA1B36-4AB100	49 $\frac{1}{4}$	255
38	200	NA1B38-3AB200	57 $\frac{1}{2}$	300	NA1B38-4AB100	52	270
40	200	NA1B40-3AB200	57 $\frac{1}{2}$	325	NA1B40-4AB100	52	285
42	200	NA1B42-3AB200	60 $\frac{1}{4}$	350	NA1B42-4AB100	54 $\frac{3}{4}$	300

Number of Circuits	Main Amps.	Types A2B-2L and A2B-2AB—Double Pole Mains 125 Volt, 2 Wire—Branches 125 Volt, 2 Wire			Types NA2B-3L and NA2B-3AB, 3 Wire Mains, 3 Wire Branches—Mains 125/250 Volt, 3 Wire Solid Neutral Branches 125/250 Volt, 3 Wire Solid Neutral		
		Panel, box and front Cat. No.	Height of Box I. d., In.	Approx. Ship. Wt., Lb.	Panel, box and front Cat. No.	Height of Box I. d., In.	Approx. Ship. Wt., Lb.
MAIN LUGS ONLY							
4	50	A2B04-2L050	19	85	NA2B04-3L050	19	87
6	100	A2B06-2L100	21 $\frac{3}{4}$	95	NA2B06-3L100	21 $\frac{3}{4}$	97
8	100	A2B08-2L100	24 $\frac{1}{2}$	115	NA2B08-3L100	24 $\frac{1}{2}$	117
10	100	A2B10-2L100	27 $\frac{1}{4}$	125	NA2B10-3L100	27 $\frac{1}{4}$	127
12	200	A2B12-2L200	30	140	NA2B12-3L200	30	142
14	200	A2B14-2L200	32 $\frac{3}{4}$	155	NA2B14-3L200	32 $\frac{3}{4}$	157
16	200	A2B16-2L200	35 $\frac{1}{2}$	170	NA2B16-3L200	35 $\frac{1}{2}$	172
18	200	A2B18-2L200	38 $\frac{1}{4}$	200	NA2B18-3L200	38 $\frac{1}{4}$	202
20	200	A2B20-2L200	41	215	NA2B20-3L200	41	217
		Same Dimensions for 250 Volt, 2 Wire A.C. Panels					
MAIN NOFUZE CIRCUIT BREAKER							
4	50	A2B04-2AB050	24 $\frac{1}{2}$	115	NA2B04-3AB050	24 $\frac{1}{2}$	117
6	100	A2B06-2AB100	32 $\frac{3}{4}$	130	NA2B06-3AB100	32 $\frac{3}{4}$	132
8	100	A2B08-2AB100	35 $\frac{1}{2}$	145	NA2B08-3AB100	35 $\frac{1}{2}$	147
10	100	A2B10-2AB100	38 $\frac{1}{4}$	160	NA2B10-3AB100	38 $\frac{1}{4}$	162
12	200	A2B12-2AB200	46 $\frac{1}{2}$	215	NA2B12-3AB200	46 $\frac{1}{2}$	217
14	200	A2B14-2AB200	49 $\frac{1}{4}$	230	NA2B14-3AB200	49 $\frac{1}{4}$	232
16	200	A2B16-2AB200	52	245	NA2B16-3AB200	52	247
18	200	A2B18-2AB200	54 $\frac{3}{4}$	260	NA2B18-3AB200	54 $\frac{3}{4}$	262
20	200	A2B20-2AB200	57 $\frac{1}{2}$	275	NA2B20-3AB200	57 $\frac{1}{2}$	277



LOW CAPACITY NOFUZE DISTRIBUTION PANELBOARDS

Number of Circuits	Main Amps.	Types A3B-3HL and A3B-3HAB 250 Volt Service Mains 250 or 125 V., 3 Ph., 3 W. Branches 250 V., 3 Ph., 3 W.			Types A2B-3HL and A2B-3HAB 250 Volt Service Mains 250 or 125 V., 3 Ph., 3 W. Branches 250 V., 1 Ph., 2 W.			Types A2B-2HL and A2B-2HAB 250 V. a-c. or 125 V. d-c. service Mains 250 V. a-c. or 125 V. d-c., 2 Wire Branches 250 Volt, 2 Wire		
		Panel box, and front Cat. No.	Height of Box I.d., In.	Approx. Ship. Wt. Lb.	Panel, box and front Cat. No.	Height of Box I.,d. In.	Approx. Ship. Wt. Lb.	Panel, box and front Cat. No.	Height of Box I.d., In.	Approx. Ship. Wt. Lb.
MAIN LUGS										
4	50	A3B04-3HL050	21 $\frac{3}{4}$	112	A2B04-3HL050	19	102	A2B04-2HL050	19	100
6	50	A3B06-3HL050	27 $\frac{1}{4}$	134	A2B06-3HL050	21 $\frac{3}{4}$	112	A2B06-2HL050	21 $\frac{3}{4}$	110
8	50	A3B08-3HL050	30	157	A2B08-3HL050	24 $\frac{1}{2}$	127	A2B08-2HL050	24 $\frac{1}{2}$	125
10	50	A3B10-3HL050	35 $\frac{1}{2}$	186	A2B10-3HL050	27 $\frac{1}{4}$	142	A2B10-2HL050	27 $\frac{1}{4}$	140
12	50	A3B12-3HL050	38 $\frac{1}{4}$	215	A2B12-3HL050	30	157	A2B12-2HL050	30	155
14	50	A3B14-3HL050	43 $\frac{3}{4}$	242	A2B14-3HL050	32 $\frac{3}{4}$	167	A2B14-2HL050	32 $\frac{3}{4}$	165
16	50				A2B16-3HL050	35 $\frac{1}{2}$	187	A2B16-2HL050	35 $\frac{1}{2}$	185
18	50				A2B18-3HL050	38 $\frac{1}{4}$	212	A2B18-2HL050	38 $\frac{1}{4}$	210
20	50				A2B20-3HL050	41	224	A2B20-2HL050	41	222
4	100	A3B04-3HL100	21 $\frac{3}{4}$	113	A2B04-3HL100	19	103	A2B04-2HL100	19	101
6	100	A3B06-3HL100	27 $\frac{1}{4}$	135	A2B06-3HL100	21 $\frac{3}{4}$	113	A2B06-2HL100	21 $\frac{3}{4}$	111
8	100	A3B08-3HL100	30	158	A2B08-3HL100	24 $\frac{1}{2}$	128	A2B08-2HL100	24 $\frac{1}{2}$	126
10	100	A3B10-3HL100	35 $\frac{1}{2}$	188	A2B10-3HL100	27 $\frac{1}{4}$	143	A2B10-2HL100	27 $\frac{1}{4}$	141
12	100	A2B12-3HL100	38 $\frac{1}{4}$	217	A2B12-3HL100	30	158	A2B12-2HL100	30	156
14	100	A3B14-3HL100	43 $\frac{3}{4}$	242	A2B14-3HL100	32 $\frac{3}{4}$	169	A2B14-2HL100	32 $\frac{3}{4}$	167
16	100				A2B16-3HL100	35 $\frac{1}{2}$	189	A2B16-2HL100	35 $\frac{1}{2}$	187
18	100				A2B18-3HL100	38 $\frac{1}{4}$	214	A2B18-2HL100	38 $\frac{1}{4}$	212
20	100				A2B20-3HL100	41	226	A2B20-2HL100	41	224
4	225	A3B04-3HL225	24 $\frac{1}{2}$	114	A2B04-3HL225	21 $\frac{3}{4}$	104	A2B04-2HL225	21 $\frac{3}{4}$	102
6	225	A3B06-3HL225	30	136	A2B06-3HL225	24 $\frac{1}{2}$	114	A2B06-2HL225	24 $\frac{1}{2}$	112
8	225	A3B08-3HL225	32 $\frac{3}{4}$	159	A2B08-3HL225	27 $\frac{1}{4}$	129	A2B08-2HL225	27 $\frac{1}{4}$	122
10	225	A3B10-3HL225	38 $\frac{1}{4}$	189	A2B10-3HL225	30	144	A2B10-2HL225	30	142
12	225	A3B12-3HL225	41	218	A2B12-3HL225	32 $\frac{3}{4}$	159	A2B12-2HL225	32 $\frac{3}{4}$	157
14	225	A3B14-3HL225	46 $\frac{1}{2}$	245	A2B14-3HL225	35 $\frac{1}{2}$	170	A2B14-2HL225	35 $\frac{1}{2}$	168
16	225				A2B16-3HL225	38 $\frac{1}{4}$	190	A2B16-2HL225	38 $\frac{1}{4}$	188
18	225				A2B18-3HL225	41	215	A2B18-2HL225	41	213
20	225				A2B20-3HL225	43 $\frac{3}{4}$	227	A2B20-2HL225	43 $\frac{3}{4}$	225
4	400	A3B04-3HL400	27 $\frac{1}{4}$	116	A2B04-3HL400	24 $\frac{1}{2}$	106	A2B04-2HL400	24 $\frac{1}{2}$	104
6	400	A3B06-3HL400	32 $\frac{3}{4}$	138	A2B06-3HL400	27 $\frac{1}{4}$	116	A2B06-2HL400	27 $\frac{1}{4}$	114
8	400	A3B08-3HL400	35 $\frac{1}{2}$	161	A2B08-3HL400	30	131	A2B08-2HL400	30	129
10	400	A3B10-3HL400	41	192	A2B10-3HL400	32 $\frac{3}{4}$	146	A2B10-2HL400	32 $\frac{3}{4}$	144
12	400	A3B12-3HL400	43 $\frac{3}{4}$	221	A2B12-3HL400	35 $\frac{1}{2}$	163	A2B12-2HL400	35 $\frac{1}{2}$	161
14	400	A3B14-3HL400	49 $\frac{1}{4}$	246	A2B14-3HL400	38 $\frac{1}{4}$	173	A2B14-2HL400	38 $\frac{1}{4}$	171
16	400				A2B16-3HL400	41	193	A2B16-2HL400	41	191
18	400				A2B18-3HL400	43 $\frac{3}{4}$	218	A2B18-2HL400	43 $\frac{3}{4}$	216
20	400				A2B20-3HL400	46 $\frac{1}{2}$	230	A2B20-2HL400	46 $\frac{1}{2}$	228
MAIN BREAKER										
4	50	A3B04-3HAB050	27 $\frac{1}{4}$	150	A2B04-3HAB050	24 $\frac{1}{2}$	144	A2B04-2HAB050	24 $\frac{1}{2}$	142
6	50	A3B06-3HAB050	32 $\frac{3}{4}$	168	A2B06-3HAB050	27 $\frac{1}{4}$	162	A2B06-2HAB050	27 $\frac{1}{4}$	161
8	50	A3B08-3HAB050	35 $\frac{1}{2}$	195	A2B08-3HAB050	30	180	A2B08-2HAB050	30	178
10	50	A3B10-3HAB050	41	220	A2B10-3HAB050	32 $\frac{3}{4}$	198	A2B10-2HAB050	32 $\frac{3}{4}$	196
12	50	A3B12-3HAB050	43 $\frac{3}{4}$	255	A2B12-3HAB050	35 $\frac{1}{2}$	216	A2B12-2HAB050	35 $\frac{1}{2}$	214
14	50	A3B14-3HAB050	49 $\frac{1}{4}$	282	A2B14-3HAB050	38 $\frac{1}{4}$	234	A2B14-2HAB050	38 $\frac{1}{4}$	232
16	50				A2B16-3HAB050	41	252	A2B16-2HAB050	41	250
18	50				A2B18-3HAB050	43 $\frac{3}{4}$	270	A2B18-2HAB050	43 $\frac{3}{4}$	268
20	50				A2B20-3HAB050	46 $\frac{1}{2}$	298	A2B20-2HAB050	46 $\frac{1}{2}$	296
4	50	A3B04-3HAB100	32 $\frac{3}{4}$	157	A2B04-3HAB100	30	146	A2B04-2HAB100	30	144
6	50	A3B06-3HAB100	38 $\frac{1}{4}$	175	A2B06-3HAB100	32 $\frac{3}{4}$	164	A2B06-2HAB100	32 $\frac{3}{4}$	162
8	50	A3B08-3HAB100	41	202	A2B08-3HAB100	35 $\frac{1}{2}$	182	A2B08-2HAB100	35 $\frac{1}{2}$	180
10	50	A3B10-3HAB100	46 $\frac{1}{2}$	227	A2B10-3HAB100	38 $\frac{1}{4}$	200	A2B10-2HAB100	38 $\frac{1}{4}$	198
12	50	A3B12-3HAB100	49 $\frac{1}{4}$	262	A2B12-3HAB100	41	218	A2B12-2HAB100	41	216
14	50	A3B14-3HAB100	54 $\frac{3}{4}$	289	A2B14-3HAB100	43 $\frac{3}{4}$	236	A2B14-2HAB100	43 $\frac{3}{4}$	234
16	50				A2B16-3HAB100	46 $\frac{1}{2}$	254	A2B16-2HAB100	46 $\frac{1}{2}$	252
18	50				A2B18-3HAB100	49 $\frac{1}{4}$	272	A2B18-2HAB100	49 $\frac{1}{4}$	270
20	50				A2B20-3HAB100	52	300	A2B20-2HAB100	52	298
4	225	A3B04-3HAB225	41	175	A2B04-3HAB225	38 $\frac{1}{4}$	169	A2B04-2HAB225	38 $\frac{1}{4}$	167
6	225	A3B06-3HAB225	46 $\frac{1}{2}$	193	A2B06-3HAB225	41	187	A2B06-2HAB225	41	185
8	225	A3B08-3HAB225	49 $\frac{1}{4}$	220	A2B08-3HAB225	43 $\frac{3}{4}$	205	A2B08-2HAB225	43 $\frac{3}{4}$	203
10	225	A3B10-3HAB225	54 $\frac{3}{4}$	245	A2B10-3HAB225	46 $\frac{1}{2}$	223	A2B10-2HAB225	46 $\frac{1}{2}$	221
12	225	A3B12-3HAB225	57 $\frac{1}{2}$	280	A2B12-3HAB225	49 $\frac{1}{4}$	231	A2B12-2HAB225	49 $\frac{1}{4}$	229
14	225	A3B14-3HAB225	63	307	A2B14-3HAB225	52	259	A2B14-2HAB225	52	257
16	225				A2B16-3HAB225	54 $\frac{3}{4}$	277	A2B16-2HAB225	54 $\frac{3}{4}$	275
18	225				A2B18-3HAB225	57 $\frac{1}{2}$	295	A2B18-2HAB225	57 $\frac{1}{2}$	293
20	225				A2B20-3HAB225	60 $\frac{1}{4}$	323	A2B20-2HAB225	60 $\frac{1}{4}$	321

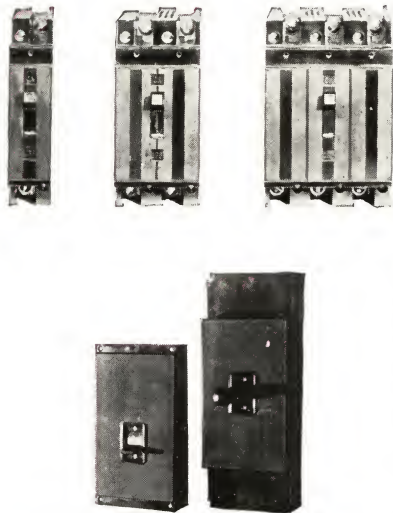
INCREASE IN BOX HEIGHTS FOR INCREASED MAIN BUS CAPACITY

FOR LUGS ONLY IN THE MAINS

FOR CIRCUIT BREAKER IN MAINS

Type of Panelboard	From 50 Amperes to 100 Amperes	From 50 Amperes to 200 Amperes	From 100 Amperes to 200 Amperes	Type of Panelboard	From 50 Amperes to 100 Amperes	From 50 Amperes to 200 Amperes	From 100 Amperes to 200 Amperes
NA1B-3L	None	None	None	NA1B-3AB	5 $\frac{1}{2}$ "	11"	5 $\frac{1}{2}$ "
A2B-2L	None	None	None	A2B-2AB	5 $\frac{1}{2}$ "	11"	5 $\frac{1}{2}$ "
NA2B-3L	None	None	None	NA2B-3AB	5 $\frac{1}{2}$ "	11"	5 $\frac{1}{2}$ "
NA1B-4L	None	None	None	NA1B-4AB	5 $\frac{1}{2}$ "	11"	5 $\frac{1}{2}$ "
A2B-3L	None	None	None	A2B-3AB	5 $\frac{1}{2}$ "	11"	5 $\frac{1}{2}$ "



TYPICAL SPECIFICATIONS FOR AUTOMATIC CIRCUIT BREAKERS**TYPICAL SPECIFICATION A****De-ion Circuit Breakers 600 Amperes and Below**

"AB" DE-ION SWITCHBOARD AND
PANELBOARD BREAKERS 600 AMPERES
AND BELOW

Except for circuit breakers in lighting panelboard branch circuits which shall be single pole calibrated at 15 ampere, automatic circuit breakers shall be 2 pole or 3 pole, with trip elements calibrated for 15 to 600 amperes, in wire size capacities as shown on plans. Multi-pole breakers shall be so designed that all poles will break simultaneously and all poles shall be effectively barred from one another. All breakers shall be approved by the Underwriters for at least 250 volt a-c. per pole.

Breakers of 50 ampere frame capacity or less shall be unit type with permanent trip elements. Breakers of 70 to 600 ampere capacity shall have removable trip elements for ready interchangeability.

Pole spacing on all 50-A frame breakers shall be uniform. Pole spacing on 100 to 600 ampere frames shall be uniform and twice that of the 50 ampere frame.

Automatic tripping of 50 ampere frame breakers is to be secured by means of a bimetallic thermal element on each pole engaging a common trip. All breakers above the 50 ampere frame size shall have a similar trip arrangement supplemented by an instantaneous trip on current values not less than 5 times normal and above. The trip of elements shall insure constant calibration and be capable of withstanding excessive short circuit conditions without injury.

The individual tripping elements shall be enclosed and sealed in units of approved molded composition to eliminate tampering or unauthorized changes in calibration.

The circuit breakers shall have inverse-time-limit characteristics, so that tripping will be prevented on momentary overloads but will occur before dangerous values are reached.

The breakers shall be operable in any position and removable from the front of panelboard without disturbing adjacent units.

The mechanism shall trip free from the handle so that contacts cannot be held closed against short circuit or abnormal overloads.

The breaker shall have a quick make and quick-break toggle mechanism whether actuated automatically or manually. Contacts shall be non-welding under operating conditions. The stationary contacts shall be an integral part of the breakers.

Automatic tripping shall be positively indicated from the manual "on" and "off" by the position of the handle.

Current-carrying parts, except thermal elements, if of copper or copper alloy, shall not rise in temperature in excess of 30 deg. C. while carrying rated current at rated frequency.

All individual breakers shall bear the Underwriters' Laboratories Inspection Label.

TYPICAL SPECIFICATION B**AIR CIRCUIT BREAKERS ABOVE 600 AMPERES**

Air Circuit Breakers shall be rated (select rating).

480 Volts A.C. or 250 Volts D.C. without Barriers

650 Volts A.C. or 750 Volts D.C. with Barriers

Breakers shall have interrupting capacities of: (specify)

20,000 amps.

40,000 amps.

60,000 amps.

80,000 amps.

Amp. Capacities and number of poles shall be as indicated on the drawings or as specified herein.

Silver shall be furnished on the main contact surfaces. All main conductors shall be of high conductivity copper. Arcing and auxiliary contacts shall provide adequate protection to the main contacts when opening current.

The breakers shall be of the type known as "trip free" which cannot be held closed on overload. The latch tripping device shall have a preliminary movement so that the tripping point will be independent of latch friction.

All breaker parts shall be easily accessible for inspection and repairs. The breaker frame will be of sturdy construction, yet provide accessibility to both the upper and lower main contacts, and working parts. Means shall be provided for reducing the shock incident to breaker opening and also for preventing excessive rebound of the mechanism or contacts, once they have opened.

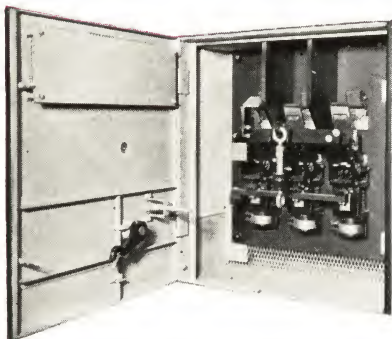
The breaker mechanism shall conform with N.E.M.A. Standards for live frame construction, and shall be furnished with insulated handles. The mechanism shall be so designed that equal pressures will be maintained on both the upper and lower contacts, when the breaker is closed.

Circuit breakers shall be provided with

SELECT	Series Overload Trip attachment (1, 2 or 3)
REQUIREMENTS	Inverse Time Limit attachment
	Shunt Trip attachment (Give control voltage)
	Under Voltage attachment
	Reverse Current attachment
	Auxiliary Switches (A and B stages required)
	Bell Alarm Switch
	Field Discharge Switch
	and arranged for

SELECT	Manual
DESIRED	D.C. Solenoid (..... Volts)
METHOD	A.C. Rectox Solenoid operation
OF OPERATION	

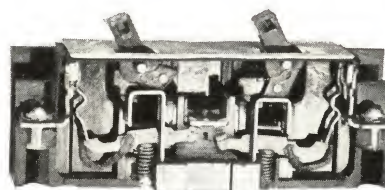
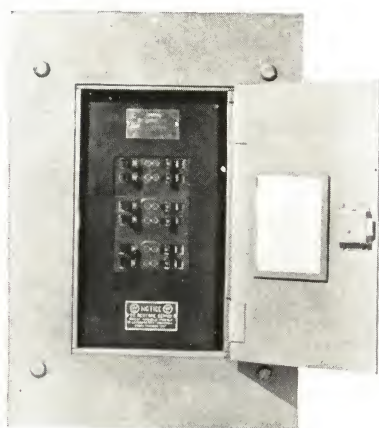
The millivolt drop shall not exceed 4 millivolts across each contact at rated current. No circuit breaker shall exceed a temperature rise of 30° C. on the contacts, when carrying its rated load at 40° C. ambient, in accordance with N.E.M.A. Standards.



SWITCHBOARD AIR CIRCUIT BREAKERS
ABOVE 600 AMPERES



MULTI-BREAKER LIGHTING PANELBOARD SAFETY TYPE NM1B



APPLICATION

The type NM1B Nofuze Panelboard has been designed to meet the need of a low priced circuit breaker type lighting panelboard. It can be used where the service is A-C. and not over 115 volts to ground. It meets all Underwriters' requirements.

FEATURES

CIRCUIT BREAKER UNITS—The circuit breaker units used are the same as those used in the latest Nofuze load centers and have four single-pole breakers mounted in a common unit. The breakers are slow-make and slow-break when actuated manually although automatic tripping is quick-break.

PANELBOARD CONSTRUCTION—Due to the type of construction, the panelboard is not quite as flexible as to circuit arrangement as the higher priced panels, but it is still of a design that almost any normal lighting application can be taken care of including some cases of light-duty power circuits.

The standard panel is furnished with main lugs only. Service can be arranged for 3/2-wire single-phase or 3-phase 4-wire. While catalog numbers cover branch circuits calibrated at 15 amperes; 20, 25, 35, and 50-ampere calibrations can be furnished if specifically requested.

The design provides for branch circuits from 4 to 40 single-pole or 18 double-pole. However, in order to meet heating limitations certain requirements must be adhered to in the layout and construction of the assembly. The established limitation is a maximum of 100 amperes total capacity in a single unit. Furthermore, not more than two 50-ampere circuits can be supplied per unit. It is to be noted, however, that with maximum circuit and main bus capacities, this panelboard is suitable for use at the high demand factor of 60 to 70 per cent which is better than that normally obtained without undue heating in other than circuit breaker types of panelboards. This should be considered when computing circuit capacities.

The boxes are of the same high-grade construction as employed for other lines of Westinghouse panelboards.

HOW TO SELECT

First determine the number, size and type of branch circuits and mains. Branch breaker ratings should be selected from the table on page 37 to protect the size wire used. Then select the proper panel from Westinghouse Catalog 29-000.

Unless otherwise specified, boxes will be furnished with standard knockouts, but in the event users desire to drill their own boxes or require special drillings either will be furnished at no extra charge provided the information accompanies the

order and that where special drillings are required no changes in box dimensions are necessary in order to place the knockouts.

Under no conditions will knockouts be furnished in the back of the boxes nor will special size cabinets or cabinets to include other apparatus than listed be manufactured.

This is necessary because of the fact that the low cost of these panelboards can only be maintained by manufacturing a standardized product.

DIMENSIONS

Width of all boxes is approximately 15", depth 4 1/2" inside dimensions. Box heights for the various panels are given in Catalog 29-000.

TYPICAL SPECIFICATIONS

Lighting panelboards shall be of the safety Nofuze automatic Multi-Breaker type.

The branch circuit breakers shall be single pole and shall be rated 115 volt a-c. with trip elements calibrated for 15-20-25-35 or 50 amperes as shown on plans. Automatic release is to be secured through action of a bimetallic thermal trip element engaging the releasing latch of the mechanism.

The circuit breakers shall have inverse-time-limit characteristics and shall be trip free on overloads.

The breakers shall be in groups of 4 poles and shall be enclosed and sealed in units of approved moulded composition to eliminate tampering or unauthorized change in calibration.

They shall be interchangeable and operable in any position and removable from the front of the panelboard without disturbing adjacent units. Each branch circuit shall be distinctly numbered.

All panelboards shall be arranged with main terminal lugs at bottom.

The assembled panelboard shall be not over 7 inches wide and fastened to the cabinet by adjustable supports to provide for proper alignment.

Boxes shall be constructed of code gauge galvanized sheet steel. They shall be provided with 4-inch wiring gutters at top, bottom and sides.

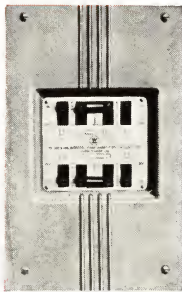
Fronts shall be of code gauge stretcher leveled sheet and steel with trim of proper width. The door shall be fastened to the trim with concealed hinges and provided with flush type chrome-plated combination latch and lock. The front shall have a priming coat of paint over which shall be supplied a finished coat of green duco.

The panelboards and cabinets shall conform to the requirements of the Underwriters' Laboratories.

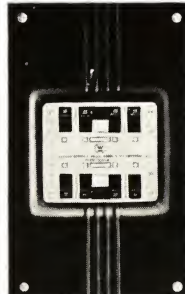
WHERE TO BUY

See nearest Westinghouse Office or agent jobber listed on back cover. For further information request Catalog 29-000.

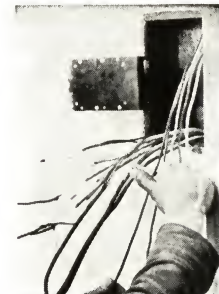
NOFUZE LOAD CENTER



FLUSH TYPE FRONT



SURFACE TYPE FRONT



SWING OUT INTERIOR MAKES INSTALLATION EASY

APPLICATION

The new Westinghouse Nofuze Load Center is an ideal form of circuit protection for residences, small stores, farm buildings and elsewhere for the control of range, water heater, lighting

and appliance branch circuits. It has been inspected and approved by the Underwriters' Laboratories, Inc., and bears their label.

FEATURES

ELIMINATES FUSES AND SWITCHES—Westinghouse Nofuze Load Centers completely eliminate the need for replacing fuses when a short circuit or overload endangers the electrical wiring in the home. Instead of fuses, the Westinghouse Nofuze Load Center employs small circuit breakers which automatically trip open under conditions which would cause a fuse to "blow". With Nofuze circuit protection you have merely to remove the cause of the "short" or overload, then flip the breaker handle first to "OFF", then to "ON"—much as you turn the lights on or off with a wall switch. There is nothing to renew or replace. Anyone can easily and safely restore service with a Westinghouse Nofuze Load Center.

LOW COST—Westinghouse Nofuze load center prices are little if any more than the old type switch and fuse.

SAFETY—Factory seal prevents exposure of live parts to unskilled fingers.

POSITIVE PROTECTION FOR WIRING SYSTEM—Factory calibration cannot be changed since the construction is tamper-proof. The breaker handle cannot be held closed against a continuous short circuit or dangerous overload.

CONVENIENCE—Because of its small size and neat appearance you can install the Nofuze Load Center in a hallway or similar location where it will be most convenient to restore service "when the lights go out". You will not even need to light a match or candle. By merely running your fingers over the Nofuze breaker handles in the dark you can immediately locate the handle which has tripped. A flip with your finger and the lights come on.

HOW TO SELECT

Before attempting to select a load center, determine which type is required. The grounded neutral load center is used primarily as service entrance equipment and is limited to six branch circuits when a main switch is not used (refer to paragraph 2351-A of N.E.C. code). The insulated neutral type is generally required when the installation is made at some point other than the point of entrance of the service conductors.

This load center can be obtained up to 16 single poles.

After the type has been decided, determine the number of circuits required, keeping in mind that each 115/230-volt or 230-volt circuit requires a two-pole breaker (2 poles) and that each 115-volt circuit requires a single-pole breaker (1 pole). 2-pole breakers are actually two single-pole breakers with handles tied together mechanically.

DIMENSIONS

Outline dimensions of load center boxes are shown in inches on the drawing.

TYPICAL SPECIFICATION

Load Center equipment shall be of the NOFUZE MULTI-BREAKER LOAD CENTER type. It shall include:

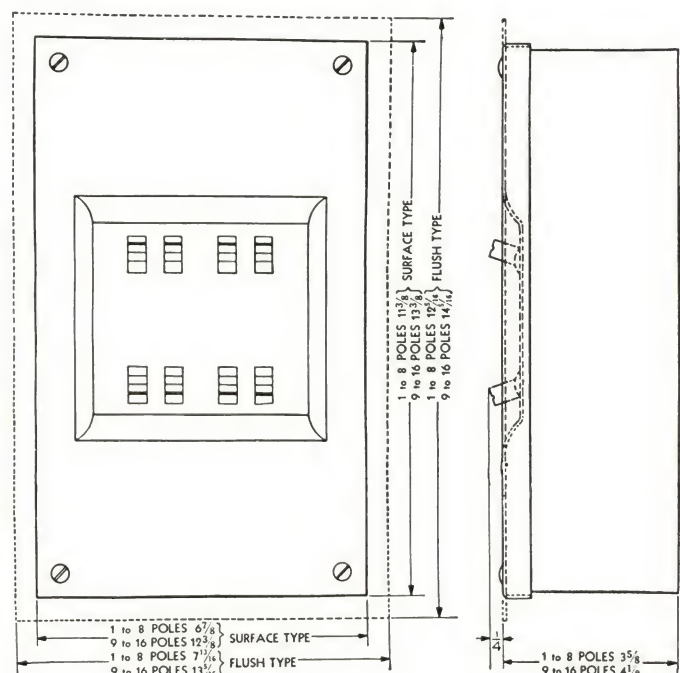
-branch circuits.....ampere single pole (2 wire S/N) 115 volt for lighting
-branch circuits.....ampere single pole (2 wire S/N) 115 volt for appliances
-branch circuits.....ampere two pole (3 wire S/N) 115/230 volt for ranges
-branch circuits.....ampere two pole (3 wire S/N) 115/230 volt for appliances

The box shall be equipped with a swing-out interior and adapted to (flush) (surface) mounting. Solid mains shall be supplied for (2 wire 115 volt a.c.) (3 wire 115/230 volt a.c.) single phase or 3 phase 4 wire, with.....ampere terminals. When application is for service entrance work, the load center shall bear Underwriters' Service Equipment Label.

WHERE TO BUY

See your nearest Westinghouse agent jobber. See list on the inside back cover.

For complete information on Nofuze Load Centers request a copy of Catalog 29-300.



OUTLINE DIMENSIONS FOR BOTH 8 AND 16-POLE LOAD CENTERS



ENCLOSED "DE-ION" NOFUZE CIRCUIT BREAKERS TYPE ABI



TYPE ABI 100 AMP. INDUSTRIAL BREAKER. SURFACE MOUNTING DUST-RESISTING ENCLOSURE. 250 VOLTS D-C., 600 VOLTS A-C. MAX.



ABI LIGHT DUTY BREAKER WITH COVER REMOVED, 125/250 VOLTS



TYPE ABI BREAKER IN CAST ALUMINUM WEATHER-RESISTING ENCLOSURE. 250 VOLTS D-C., 600 VOLTS A-C. MAX.



EXPLOSION-RESISTING 50 AMPERE TYPE ABI "NOFUZE" BREAKER. 250 VOLTS D-C., 600 VOLTS A-C. MAX.

APPLICATION

ABI Circuit Breakers are ideally adapted for the protection of electrical circuits. Ratings are available in single, double and triple pole from 15 amperes up to 50 amperes, 125/250 volts a-c. or d-c.; 15 amperes up to and including 600 amperes,

2 and 3 pole rated 230 volts a-c., 125/250 volts d-c., 250 volts d-c. and 600 volts a-c. Enclosures for practically all applications are available; sheet steel, sheet steel dust-resisting, cast iron or aluminum weather-proof and explosion-proof.

FEATURES

FUSELESS CIRCUIT PROTECTION. Operation is of the thermal principle and tripping is accomplished by bimetals. There are no elements to renew after circuit interruption.

TIME DELAY TRIPPING. The inverse-time-limit feature of the bi-metallic trip elements prevent unnecessary tripping

on momentary overloads, but provides instantaneous tripping on heavy short circuits.

TRIP FREE HANDLE. It is impossible to hold the circuit breaker closed against abnormal overloads or short circuits.

TAMPER PROOF. The tripping mechanisms are sealed to prevent unauthorized changing of calibration.

HOW TO SELECT

Breakers are calibrated to conform to commercial wire sizes. The proper breaker should be selected from the table on page 37

1—If circuits are to feed motors, the proper rating of branch circuit breaker should be selected from the table page 36.

DIMENSIONS AND RATINGS

See Westinghouse Catalog 29-500.

TYPICAL SPECIFICATIONS

Enclosed circuit breakers shall be of the De-ion thermal type either 2 or 3 pole, 250 volts, d-c. or 600 volts, a-c. with trip elements calibrated from 15 to 600 amperes as indicated on the plans or specified herein.

THE ENCLOSURE shall be constructed of code gauge steel protected with a baked black japan finish, Cast Aluminum Water and Dust-Tight, Cast Iron Water and Dust-Tight or Cast Iron Explosion Resisting as indicated on plans or specified herein. The enclosure shall have a front-operated handle with a bracket

that permits the use of three padlocks for locking in the "off" position. The code gauge steel enclosure is to be gasketed to make it dust-resisting and the cover interlocked so that it can be opened only when the breaker is in the "off" position. The enclosure shall be equipped with a 2-way centering cover latch with knockouts for padlocking or sealing the cover in place.

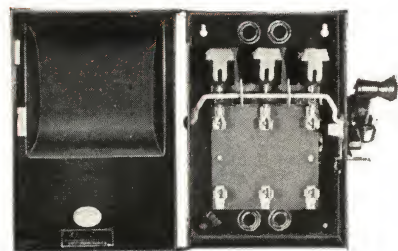
AUTOMATIC CIRCUIT BREAKER (See page 16 Spec. A for detailed circuit breaker specifications.)

WHERE TO BUY

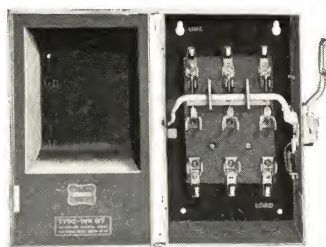
See your nearest Westinghouse district office or agent jobber. For complete information on ABI circuit breakers request a

copy of Catalog Section 29-500. Addresses of local offices are given on the back cover.



Westinghouse**SAFETY SWITCHES**

60 AMP. TYPE A, QUICK-MAKE AND QUICK-BREAK INTERLOCKING SAFETY SWITCH, 575 VOLTS, EQUIPPED WITH DE-ION ARC QUENCHERS



60 AMP. TYPE C, QUICK-MAKE AND QUICK-BREAK SAFETY SWITCH, 250 VOLTS



100 AMPERE TYPE D SLOW MAKE, QUICK BREAK SAFETY SWITCH, 250 VOLTS

APPLICATION

Used for the protection of motor and feeder circuits and as motor disconnects. Available in standard ratings from 30 to

1200 amperes (NEMA sizes), 125/250 volts a-c. or d-c, to 600 volts d-c, 575 volts a-c. fusible and non-fusible.

FEATURES

DIAMOND POINTED BREAK JAW and EXTENDED BLADE construction, used on all switches, carries the arcing outside the contact area.

FRONT REMOVABLE one-piece copper parts are used.

"DE-ION" ARC QUENCHER. The Westinghouse "De-ion"

arc quencher is used on all 575 and 600 volt switches. It consists of a series of cadmium plated, slotted steel plates so mounted that the blades of the switch must pass through the slot when the switches are being opened. The arc is divided, cooled and deionized by these plates, causing it to be extinguished instantly.

HOW TO SELECT

Type A switches are quick make and quick break with interlocked door; Type C switches are quick make and quick break;

Type D are quick break. A switch of the rating desired and type required by the application should be selected.

DIMENSIONS

See Westinghouse Catalog 29-500.

TYPICAL SPECIFICATIONS

Safety switches shall be of type (A), (C), (D) construction, and shall be fusible or non-fusible as required with ratings as indicated on the plans or as specified herein.

Type "A" Switches shall be Westinghouse or equivalent, externally operated with a quick make and quick break mechanism, and shall be provided with a mechanical interlock to prevent the door being opened unless switch is in the "off"

position.

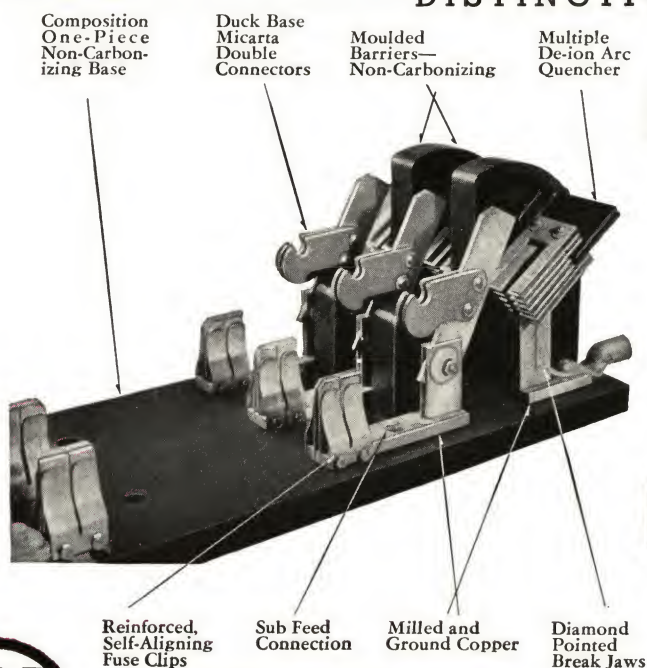
Type "C" Switches shall be Westinghouse or equivalent externally operated with a quick make and quick break mechanism.

Type "D" Switches shall be Westinghouse or equivalent externally operated with a quick-break mechanism.

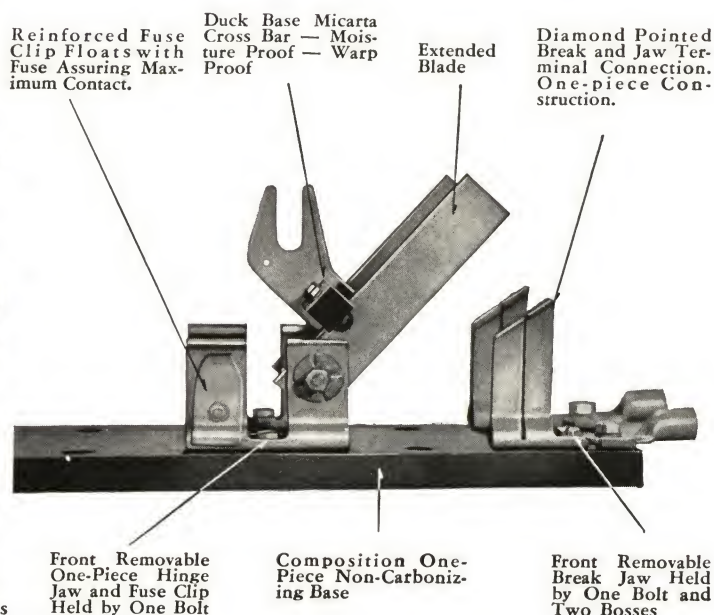
All Safety Switches shall conform with the requirements and have the approval of Underwriters' Laboratories, Inc.

WHERE TO BUY

See your nearest Westinghouse Agent Jobber listed on back cover. For complete information request catalog 29-500.

DISTINCTIVE FEATURES

BASE ASSEMBLY FOR TYPE A SWITCH, 400 AMPERES, 575 VOLTS



BASE ASSEMBLY FOR TYPE A SWITCH, 100 AMPERES 250 VOLTS



MOTORS DESIGNED TO MEET SPECIAL CONDITIONS

QUIET OPERATION

Westinghouse Quiet Operating Motors are specially designed and tested under load conditions in a sound-proof room, insuring a high standard of quietness.

Standard motors, though sufficiently quiet for the usual installation, may not be quiet enough for certain building applications. By using specially designed quiet operating motors the noise can be reduced to such an extent that their operation, when properly installed, will be entirely satisfactory for such installations.

Westinghouse Quiet Operating Motors bear a special nameplate. This is your assurance that these motors are designed and tested for the requirements of quiet service.

Where quiet operating motors are necessary, specifications should definitely call for "Westinghouse Quiet Operating Motors, with nameplates designating them as such." Terms such as "noiseless motors" or "commercially quiet motors" should not be used.

SPLASH-PROOF

A complete line of Westinghouse motors and control, fully protected against splashing or dripping water, may be used indoors where the hose is used freely for cleaning or they may be installed outdoors with no additional protection.

Liquids or solids, striking the new Westinghouse a-c. motors, cannot enter. The all-cast-iron construction of frame, brackets and conduit boxes of these motors provides maximum protection against rust and corrosion. No sheet steel used. Effective baffles, cast as part of the end brackets, prevent the entrance of water directed at the base of the motors. Their cast-iron conduit box, too, is thoroughly protected. Liberal bottom openings provide unrestricted ventilation. Even distribution of cooling air by means of directed ventilation prevents hot-spots in the windings. Westinghouse "Tuffernell" Dual Insulation fully protects the windings. Complete details of these thoroughly protected motors and control are obtainable from your nearest Westinghouse Representative.

VERTICAL PUMP MOTORS

"Bullet Type" Vertical Hollow Shaft Squirrel-Cage Motors are especially designed for deep well pumping service. They are of weather-proof construction—the solid cast frame with weather-proof hood protects the motor from rain or dripping liquids. Water cannot drip in or on to the windings which have "Tuffernell" Insulation and are given the dual protection treatment. They are protected against power reversals by a jaw type clutch which automatically disengages should the motor accidentally operate in the reverse direction. Supplied in all commercial speeds, frequencies and voltages.

EXPLOSION-RESISTING

Westinghouse explosion-resisting type CS squirrel-cage motors have been designed for use in Class 1, Group D Hazardous Locations. They are safe to use in hazardous atmospheres containing gasoline or other petroleum vapors, or similar explosive materials. Their construction is such that live flame cannot escape to the outside of the motor should an explosion occur in the inside.

These motors have Dual Ventilation which is very effective in keeping them thoroughly cooled. This is accomplished by having heated air within the motor circulated through ducts which lie adjacent to ducts carrying cold air. These two sets of ducts are cast in the frame—one set being connected to the inside of the motor and the other set connected to the outside air causing a rapid transfer of heat from the inside to the outside, similar to a heat exchanger. These motors are more uniformly cooled and result in longer life to the windings.

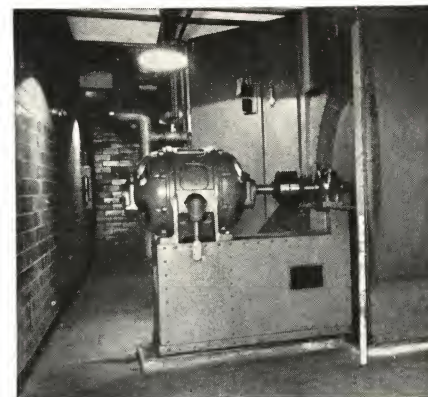
These motors may be used indoors or out, for any constant speed drives such as pumps, blowers, compressors, etc. Made in ratings from $\frac{1}{2}$ to 200 hp., for all commercial voltages and frequencies. Equipped with ball bearings. 55° C. rise.

The Explosion-Resisting Linestarter with its simple push button operation is recommended for use with these motors.

TOTALLY-ENCLOSED FAN-COOLED MOTORS

These motors are used indoors or outdoors where conditions of abrasive or conducting dust are severe. The primary laminations, windings and all electrical parts are tightly sealed within the rigid cast frame.

The construction of these standard fan-cooled motors is the same as Explosion-Resisting Motors described above except that they have a steel conduit box and steel fan guard. These fan-cooled motors may be supplied for hazardous dusty locations in which case they will be equipped with Underwriter's label indicating they have been listed for Class II Group G locations.



QUIET OPERATING TYPE CS MOTOR
DRIVING A FAN



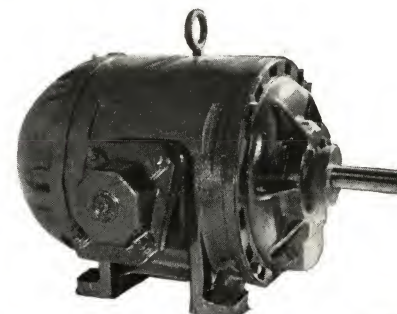
WESTINGHOUSE DRIP-PROOF SPLASH-
PROOF MOTOR



WESTINGHOUSE
BULLET TYPE
HOLLOW SHAFT
PUMP MOTOR



WESTINGHOUSE
FAN-COOLED
TOTALLY-ENCLOSED
CS MOTOR



WESTINGHOUSE
EXPLOSION-RESISTING
TYPE CS MOTOR

MOTORS AND CONTROL

FANS AND BLOWERS

In the driving of fans and blowers for constant speed application, squirrel-cage motors in the small and medium ratings are used, and squirrel-cage or synchronous motors are used on the large drives. For variable speed operation, 2 or 4-speed squirrel-cage motors can be used, or if a greater speed range is required, wound rotor motors with continuous duty resistors are used. When fans or blowers are installed in office buildings, etc., unless they are installed in sound proofed rooms, it is necessary to furnish *quiet operating motors*.

Type CS Squirrel-Cage Induction Motors, 1 hp. and up—motor specification, Page 28, control, Page 29. Type G, High Speed Synchronous Motors, 20 hp. and above, 450 rpm. to 1800 rpm., specification, Page 34.

PUMPS AND COMPRESSORS

Small and medium size compressors are usually driven by squirrel-cage motors of the linestart or general purpose type. When the compressor is not equipped with an unloader during starting, Linestart Class II high starting torque motors are recommended. Large compressors are usually driven by high-speed belted or low speed direct-connected synchronous motors, unless for stand-by or intermittent service, in which case squirrel-cage motors may be used.

Type CS Squirrel-Cage Induction Motors, 1 hp. and up—motor specification, Page 28, control, Page 29. Type G, High Speed Synchronous Motors, 20 hp. and above, 450 rpm. to 1800 rpm., specification, Page 34.

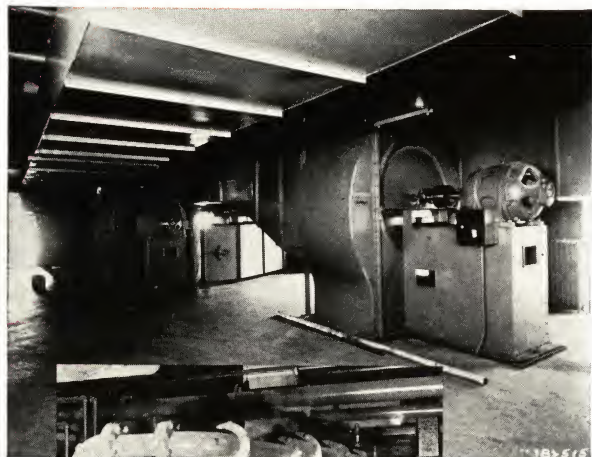
For small centrifugal pumps, squirrel-cage motors of the Linestart Class I or general purpose type are suitable. On large size units, squirrel-cage or synchronous motors are used. On many government building specifications wound rotor motors are specified due to their low starting currents.

Wound rotor motors, 1 hp. and up—motor specification, Page 30, control, Page 31.

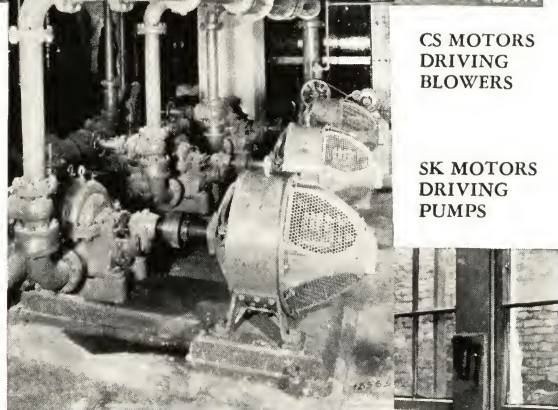
On plunger pumps we recommend type CS Linestart Class II high starting torque motors so as to take care of the full pump load plus the accelerating load. For boiler feed service and other applications requiring variable speed motors, a wound rotor motor with continuous duty resistors should be used, such as type CW sealed sleeve bearing motors.

Type CS Squirrel-Cage Induction Motors, 1 hp. and up—motor specification, Page 28, control, Page 29.

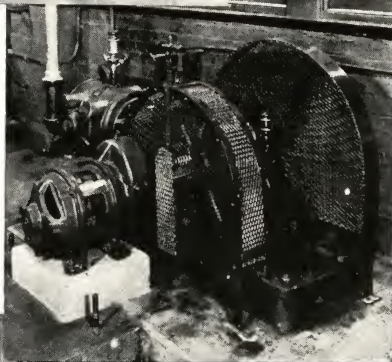
Wound rotor motors, 1 hp. and up—motor specification, Page 30, control, Page 31.



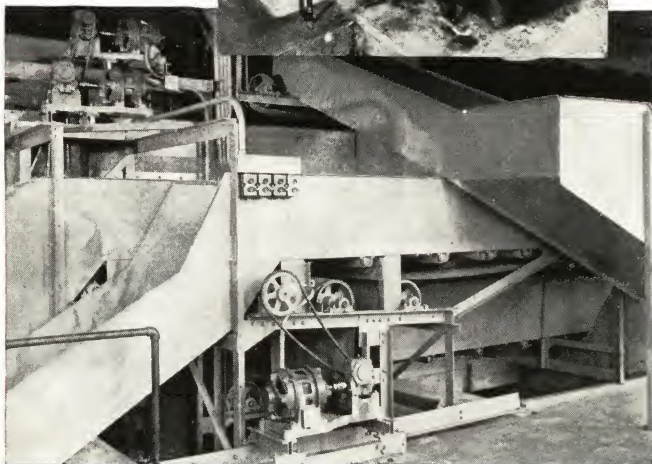
CS MOTORS
DRIVING
BLOWERS



SK MOTORS
DRIVING
PUMPS



TYPE S
GEARMOTOR
DRIVING A
COMPRESSOR



TYPE CS BALL BEARING MOTORS DRIVING
CONVEYORS THROUGH REDUCTION GEARS
AND CHAIN DRIVE



for EVERY BUILDING APPLICATION

MATERIAL HANDLING EQUIPMENT

In driving conveyors for building installations the Westinghouse Type CS Linestart Class II, Squirrel-cage Induction Motor incorporates all desirable characteristics for the purpose, particularly when the conveyor is driven through a chain, speed reducing unit or gearmotor.

In some cases the wound rotor induction type motor — types CW and CI is preferred in order to produce smoother acceleration at the conveyor than is possible with the across-the-line type starting.

We have developed all desirable combinations of gear motors for a-c. and d-c. motor applications.

Type CS Squirrel-Cage Induction Motors, 1 hp. and up—motor specification, Page 28, control, Page 29.

Wound rotor motors, 1 hp. and up—motor specification, Page 30, control, Page 31.

Type SK, direct current motors, 1 hp. and up—motor specification, Page 32, control, Page 33.

FIRE PROTECTION

Both the type CS squirrel-cage and CW wound rotor a-c. motors as well as d-c. fire pump motors have ample starting and maximum running torques so that they are sure to start on short notice.

Underwriters require that a double throw oil circuit breaker be provided to permit operation from either one of two power sources.

Type CS Squirrel-Cage Induction Motors, 1 hp. and up—motor specification, Page 28, control, Page 29. Wound rotor motors, 1 hp. and up—motor specification, Page 30, control, Page 31.

AIR CONDITIONING AND REFRIGERATION

For the smaller and medium sized compressors, Type CS Linestart Class II, High Torque Squirrel-Cage or Type CW Wound Rotor Induction Motors are used.

Westinghouse type HR low-speed engine-type synchronous motors are designed especially for driving Freon and other types of reciprocating compressors. Contact is maintained with the leading compressor builders to insure that on each installation the proper motor characteristics are provided. This includes starting performance (torques and starting kv-a.), also operating characteristics, including the fly-wheel effect necessary to limit current pulsations to a satisfactory value. Our engineers cooperate with the compressor builder's engineering departments on all matters pertaining to satisfactory building and operating the complete unit as a whole. It is recognized that noise and vibration are to be avoided as much as possible in an air conditioning installation and type HR engine type synchronous motors are designed to avoid noise producing harmonics.

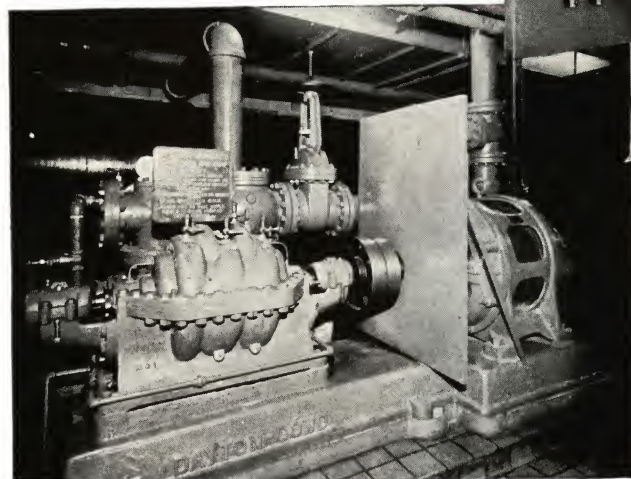
A large motor installation in buildings frequently requires increment type control to limit the starting current or other control features requiring coordination of motor and control design. The motor characteristics and starting current limitations determine the choice of starting method which may be full voltage or reduced voltage by auto transformer, series reactor, saturable reactor, or primary resistance. Loading and unloading the compressor may also be accomplished by interlocking a magnetic compressor unloader with the control.

Type CS Squirrel-Cage Induction Motors, 1 hp. and up—motor specification, Page 28, control, Page 29.

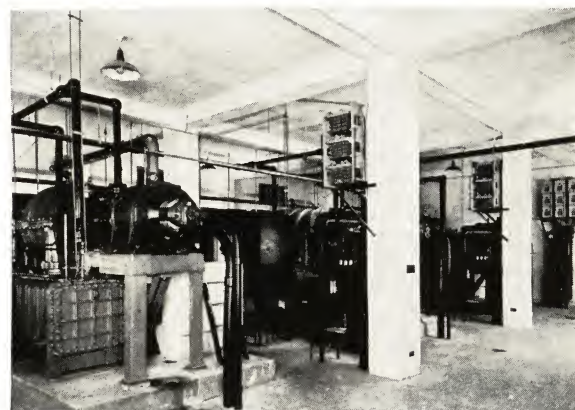
Wound rotor motors, 1 hp. and up—motor specification, Page 30, control, Page 31.

Type G, High Speed Synchronous Motors, 20 hp. and above, 450 rpm to 1800 rpm, specification, Page 34.

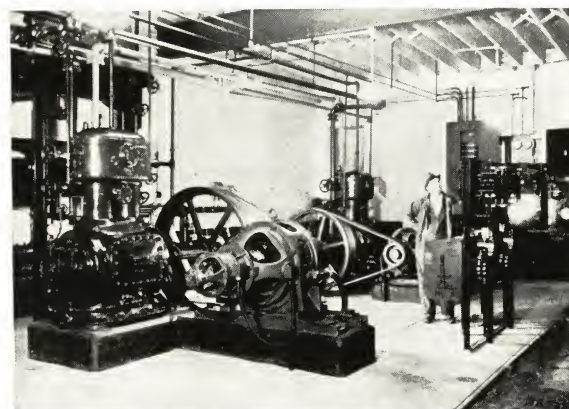
CONTROL
UNIT FOR
FIRE-
PROTECTION
EQUIPMENT



CW MOTOR DRIVING A FIRE PUMP

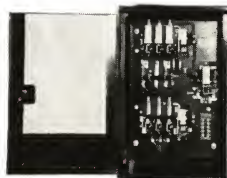


TYPE CW MOTORS DRIVING COMPRESSORS



100 HP. AND 60 HP. 220 VOLT, 3 PHASE, 60 CYCLE 1200 RPM. 80% POWER FACTOR TYPE G SYNCHRONOUS MOTORS DRIVING 50-TON AND 40-TON AMMONIA COMPRESSORS THROUGH V-BELT DRIVE

MOTOR CONTROL EQUIPMENT

Type H
Sentinel
BreakerTypes WK-18 and
WK-16 Manual
Starters"De-ion"
Linestarter
with Built-in
Pushbutton"De-ion" Linestarter
with Separate
Pushbutton"De-ion"
Linestarter
with Built-in
Pushbutton"De-ion" Com-
bination Line-
starter and Built-in
Disconnect
SwitchesLinestarter with Hand-
Off-Automatic Selector
SwitchClass 11-400
Magnetic Reduced
Voltage StarterClass 10-700
Manual Reduced
Voltage StarterD.C. Manual Starter
and Speed RegulatorD.C. Magnetic
Starter

A complete line of Westinghouse Motor Starters is available for the Building Industry, which can be classified as follows:

Manual Starters for Single Phase Motors

Magnetic Starter for Single Phase Motors

Manual Starters for 2 and 3 Phase Squirrel-Cage Motors

Magnetic Starters for 2 and 3 Phase Squirrel-Cage Motors

Combination Linestarters for 2 and 3 Phase Squirrel-Cage Motors

Control for Constant and Varying Speed Wound Rotor Induction Motors

Control for Direct Current Motors

NEMA Type 1 general purpose sheet metal enclosures are generally suitable for buildings, but special enclosures are available where required. Typical special enclosures are:

Water-tight and dust-tight cast iron cases for breweries, dairies and outside applications (NEMA Type 4)

Gasketed heavy sheet steel dust-tight enclosures for foundries, cement plants, etc. (NEMA Type 5)

Air Break and Oil Immersed starters for hazardous locations (NEMA Types 7, 8 and 9)

ACROSS-THE-LINE STARTING

The usual method of starting for single phase A.C. motors and polyphase squirrel-cage motors is by connecting the motor windings directly to the line by either manual or magnetic means. This permits the use of the simplest form of control with minimum cost.

Across-the-line starting can be applied wherever induction motors are used. In some cases, where the capacity of the power supply is limited, the power company or local inspection bureau place a maximum hp. limitation for across-the-line starting due to the effect of the motor starting current on the line voltage. For information regarding such limitation on any project consult your Westinghouse representative.

For small A.C. motors, where automatic operation from a thermostat or other pilot device is not required, the Sentinel Breaker and Motor Watchman (Types WK-16 and WK-18) manual starters are recommended for across-the-line starting. They provide thermal protection against locked rotor operation and against overload. All metal parts are corrosion resisting. They are sturdily built for long life and dependable operation.

For larger A.C. motors, or where automatic operation from a pilot device is required or pushbutton operation desired, "De-ion" Linestarters, the outstanding development of recent years, are recommended for across-the-line starting.

REDUCED VOLTAGE STARTING

For manual reduced voltage starting of polyphase A.C. motors Class 10-700 auto starters are recommended. They provide reliable overload and low voltage protection, and are interlocked to prevent improper starting.

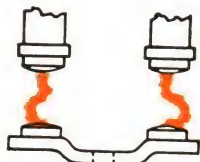
For magnetic reduced voltage starters use Class 11-400 primary resistance type. Class 11-400 starters consist essentially of a "De-ion" Linestarter unit to connect the motor to the line thru an edgewound non-breakable primary resistor, mounted in the same enclosure, and a contactor to short-circuit the resistor after an adjustable time interval determined by the automatic timing relay. They are suitable for operation from float switch or other pilot device. Thermal overload protection is provided. Type Dn. contactors give the same long life, low maintenance, dependable operation that has made "De-ion" Linestarters famous.

DIRECT CURRENT STARTERS

Manual starters and speed regulators, and magnetic starters, are illustrated and listed on page 33.

"DE-ION" LINESTARTERS

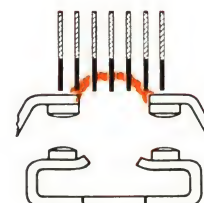
Only Westinghouse "De-Ion" Linestarters Have All the Advantages of Modern Motor Starters Plus "De-Ion" Design



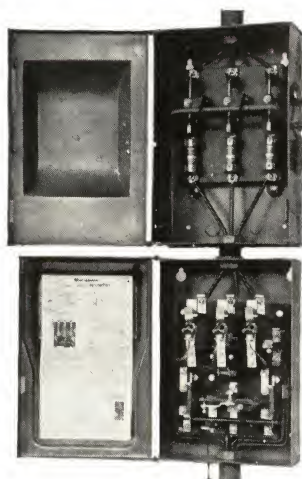
THE OLD WAY



"DE-ION" ARC
QUENCHER



THE "DE-ION" WAY



THE OLD WAY
STARTER AND DIS-
CONNECT DEVICE
INSTALLED SEPA-
RATELY

Left shows an arc being broken between double break silver contacts where stretching alone is depended upon to break the arc. The NEW WESTINGHOUSE LINESTARTERS use this same principle of arc stretching—AND IN ADDITION HAVE "DE-ION" Arc Quenchers. When the contacts of a "DE-ION" contactor separate, the arc is stretched—as shown above. Possibly this stretching is sufficient to break the arc under normal conditions. But if the load is heavy, or some abnormal condition exists, then the PLUS FACTOR—the "DE-ION" QUENCHER—comes into action as shown above right. As the contacts separate, the specially shaped moving contact connector gives a magnetic reaction that forces the two stretching arcs to join as one arc across the stationary contacts, and this arc immediately rises into the "DE-ION" grids where it is "sliced" into a series of arcs. At the next zero point on the current cycle the air adjacent to each grid is deionized instantly, the voltage per grid is insufficient to re-establish the current flow, and the arc is "out."

The "DE-ION" arc quencher confines, divides and extinguishes the arc almost instantaneously without the usual flash and scattering of flame. The result is not only high overload capacity and a high degree of safety due to freedom from flash-overs, but also practically unlimited life of arc box and contacts. By application of this distinctive Westinghouse "DE-ION" principle of arc interruption there is obtained a greater degree of safety, reliability, and low maintenance than ever before considered possible in standard motor starters.



THE MODERN WAY
"DE-ION" COMBI-
NATION LINE-
STARTER, STARTER
AND NOFUZE
BREAKER IN SAME
ENCLOSURE

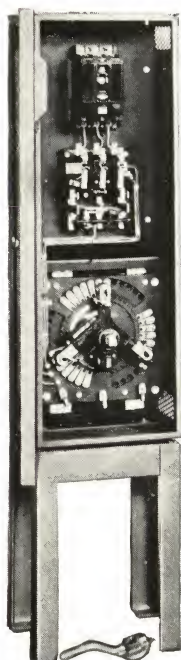
A.C. COMBINATION CONTROLLERS

For applications involving speed regulating duty with wound rotor motors, the combination of primary and secondary control in one enclosure has the advantage of better appearance, maximum convenience in operation, and lower installation cost than where the devices are installed separately.

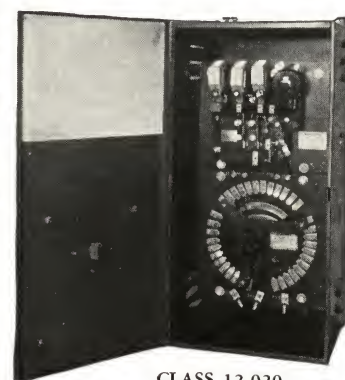
Class 12-020 consists essentially of a "De-ion" Linestarter unit, with all the advantages of "De-ion" design, combined in the same enclosure with a Class 12-012 starting rheostat or a Class 12-016 starting rheostat and speed regulator.

Complete control of the starting, stopping, and speed adjustment is obtained from the rheostat handle.

The Class 12-201 combines a Nofuze Breaker as disconnect switch in the same enclosure with the "De-ion" primary contactor and rheostat, giving the really modern installation. The Nofuze breaker is so interlocked with the door that it may be locked in either the open or closed positions, and the door of the enclosure cannot be opened by unauthorized persons.

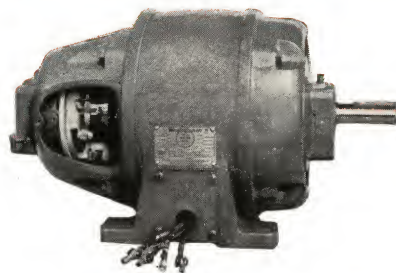


CLASS 12-201
(OPEN VIEW)



CLASS 12-020

SINGLE-PHASE A.-C. REPULSION-INDUCTION MOTORS



TYPES FR, CR AND CU SINGLE PHASE REPULSION-START INDUCTION A.-C. MOTORS*

WHAT THEY ARE—These motors are constant-speed heavy duty motors for industrial or domestic applications. They start heavy loads easily and require low starting currents.

SIZES— $\frac{3}{4}$ to $7\frac{1}{2}$ hp.

VOLTAGES—110/220 dual voltage (leads brought out for both voltages).

ADAPTABILITY—Available for standard horizontal frame, bracket, flange, and vertical mounting.

Blowers

Centrifugal Pumps

Coffee Grinders

Compressors

Concrete Mixers

Conveyors

Door Openers

Fans

Gasoline Pumps

Home Water Systems

Machine Tools

Reciprocating Pumps

Refrigerators

Saws

Stokers, etc. and practically any constant speed application where single phase A.-C. power is available

REPULSION START AC SINGLE PHASE INDUCTION MOTORS

Indicate Option

APPLICATION AND RATING (rating) Horsepower (application)

Motor shall be of the repulsion induction type

VOLTAGE $\left\{ \begin{array}{l} 110 \\ 220 \\ 440 \end{array} \right\}$ volts single phase A.C.

CYCLES $\left\{ \begin{array}{l} 25 \\ 60 \end{array} \right\}$ cycle

INSULATION NEMA Class A insulation

SPEED $\left\{ \begin{array}{l} 1160 \\ 1750 \\ 3450 \end{array} \right\}$ rpm

BEARINGS $\left\{ \begin{array}{l} \text{Sleeve} \\ \text{Ball} \end{array} \right\}$ bearing

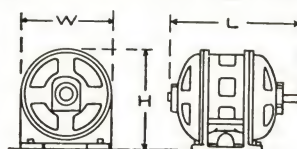
40° C. continuous temperature rise

Similar or equal to the Westinghouse type CR or CU motor and to conform in all respects to the requirements of the National Electrical Manufacturers Association.

DATA, SINGLE-PHASE, REPULSION-START INDUCTION MOTORS, TYPES FR, CR AND CU.

REPULSION-START INDUCTION MOTORS TYPES FR, CR AND CU†

Horsepower	Approx. Full Load Rpm.	Frame	Motor Type	Approx. Ship. Wt. Motor Only	Approx. F.L. Amps. 110 Volts
$\frac{1}{8}$	1725 1140	B-165 B-185	FR FR	44 66	6.2 6.7
$\frac{1}{4}$	1725 1140 870	B-185 D-185 W-224	FR FR CR	58 66 132	8.4 14.6
$\frac{3}{4}$	1725 1160 870	B-185 W-204 W-225	FR CR CR	61 90 185	12.4 12.8 21.0
1	1750 1160	W-204 W-224	CR CR	90 132	15.0 18.0
$1\frac{1}{2}$	3450 1750 1160	F-204 W-224 F-225	CR CR CR	121 132 182	16.4 19.8 28.2
2	3450 1750 1160	W-224 W-225 W-254	CR CR CU	132 154 190	24 26.2 22.8
3	3450 1750 1160	F-224 F-225 WD-254	CR CR CU	150 182 190	33 39.2 32
5	3450 1770 1160	F-225 WD-254 WH-284	CR CU CU	182 190 263	52 50 54
$7\frac{1}{2}$	1770	WH-284	CU	263	72



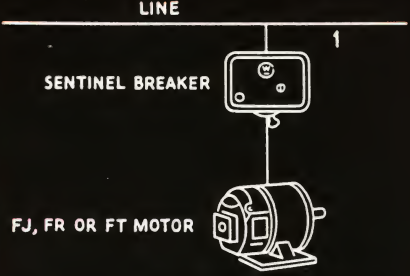
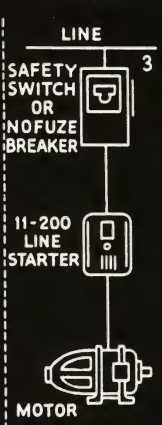
DIMENSIONS IN INCHES, TYPES FR, CR AND CU MOTORS

Frame No.	H	W	L	Weight
145	$6\frac{23}{32}$	$6\frac{1}{2}$	$11\frac{1}{8}$	38
185	$8\frac{1}{8}$	$8\frac{3}{8}$	$14\frac{1}{4}$	53
B-145	$6\frac{23}{32}$	$6\frac{1}{2}$	$11\frac{5}{8}$	38
B-165	$7\frac{13}{32}$	$7\frac{3}{4}$	$12\frac{21}{32}$	40
B-185	$8\frac{1}{8}$	$8\frac{3}{8}$	$14\frac{3}{4}$	56
D-145	$6\frac{23}{32}$	$6\frac{1}{2}$	$12\frac{1}{8}$	35
D-165	$7\frac{13}{32}$	$7\frac{3}{4}$	$13\frac{3}{32}$	42
D-185	$8\frac{1}{8}$	$8\frac{3}{8}$	$15\frac{1}{4}$	60
W-204	$9\frac{7}{8}$	10	17	90
W-224	11	11	$19\frac{1}{2}$	132
W-225	11	11	$20\frac{1}{4}$	185
F-204	$9\frac{7}{8}$	10	$18\frac{1}{2}$	121
F-224	11	11	21	150
F-225	11	11	$21\frac{3}{4}$	182
W-254	$12\frac{1}{2}$	$12\frac{1}{2}$	$24\frac{1}{4}$	190
WD-254	$12\frac{1}{2}$	$12\frac{1}{2}$	$25\frac{1}{4}$	190
WH-284	$12\frac{1}{2}$	$12\frac{1}{2}$	$26\frac{1}{4}$	263

*Capacitor motors can be used in place of repulsion start single phase motors in the same sizes.



CONTROL FOR SINGLE PHASE MOTORS

CONTROL REQUIRED	HOOK-UP	TYPICAL SPECIFICATIONS
 SENTINEL BREAKER	OPTIONAL ARRANGEMENTS LINE  SENTINEL BREAKER FJ, FR OR FT MOTOR OPTIONAL ARRANGEMENT FOR MOTORS UP TO 7½ H.P. 220 VOLTS    MANUAL STARTER SAFETY SWITCH OR NOFUZE BREAKER 11-200 LINE STARTER 10-030 STARTER MOTOR MOTOR MOTOR	SPECIFICATION A Control for Single Phase..... (Fan, Pump, etc.) Motors shall consist of a manual across-the-line starting switch providing thermal overload protection. Starter to be Westinghouse Sentinel Breaker Class 10-023 or approved equal.
 SAFETY SWITCH		SPECIFICATION B Control for Single Phase..... (Fan, Pump, etc.) Motors shall consist of a manual across-the-line starting switch providing thermal overload protection. Starter to be Westinghouse Type WK or approved equal.
 MANUAL TYPE WK STARTER		SPECIFICATION C Control for Single Phase..... (Fan, Pump, etc.) Motors shall consist of an enclosed manual primary rheostat arranged to provide reduced voltages starting and low voltage protection and suitable for wall mounting. Starter to be Westinghouse Class 10-030 or approved equal.
 NOFUZE BREAKER		SPECIFICATION D Control for Single Phase..... (Fan, Pump, etc.) Motors shall consist of an enclosed two-pole magnetic across-the-line starter providing thermal overload and low voltage protection and to be push button operated. Starter to be Westinghouse Deion Class 11-200 or approved equal.
 MANUAL REDUCED VOLTAGE STARTER		 MAGNETIC LINESTARTER

CONTROL DATA

Manual Control

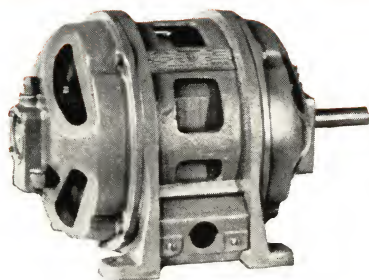
Maximum HP		Type	Width Inches	Height Inches	Depth Inches	Weight Lbs.
110 Volts	220 Volts					
1	1	"H"—S. P. Sentinel Breaker	3 ⁷ / ₁₆	3 ⁷ / ₁₆	2 ¹ / ₁₆	1
1	1	"H"—D. P. Sentinel Breaker	3 ⁷ / ₁₆	3 ⁷ / ₁₆	2 ¹ / ₁₆	1
1	1½	WK-16 Motor Watchman	5 ¹ / ₄	9 ⁵ / ₈	4 ³ / ₈	6
1½	3	WK-18 Motor Watchman	5 ¹ / ₄	9 ⁵ / ₈	4 ³ / ₈	6
1	1	10-030 Resistance Starter	12	14 ¹ / ₄	11 ³ / ₁₆	25
2	2	10-030 Resistance Starter	12	14 ¹ / ₄	11 ³ / ₁₆	25
3	3	10-030 Resistance Starter	12	14 ¹ / ₄	11 ³ / ₁₆	25
5	5	10-030 Resistance Starter	12	14 ¹ / ₄	11 ³ / ₁₆	30
7½	7½	10-030 Resistance Starter	12	14 ¹ / ₄	11 ³ / ₁₆	35

Magnetic Control

1½	3	11-200-S1 Linestarter	6 ⁵ / ₈	8 ⁷ / ₈	4 ³ / ₄	9
3	7½	11-200-S2 Linestarter	12	17 ¹ / ₄	6 ¹ / ₈	35
7½	15	11-200-S3 Linestarter	14 ⁵ / ₈	20	7 ⁷ / ₈	65
10	25	11-200-S4 Linestarter	14 ⁵ / ₈	24 ¹ / ₂	9 ¹ / ₈	100



POLYPHASE SQUIRREL-CAGE A.-C. MOTORS



TYPE CS SQUIRREL-CAGE MOTOR

WHAT THEY ARE—Most widely used squirrel-cage induction motor for constant speed industrial applications.

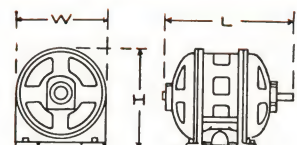
SIZES—1 to 200 hp. As a rule applications fall between 1 and 50 hp.

STANDARD VOLTAGES—110, 220, 440, 550, 2200. (Standard 220-volt motors operate satisfactorily on network voltages either 199 or 208 volts).

STANDARD FREQUENCIES—25, 50, 60 cycles. Available in general purpose Class I Linestart, and Class II Linestart designs. Use CS Motors for constant speed, heavy duty industrial drives. Splash-proof, fan-cooled, explosion-resisting and standard enclosures are available.

TYPE OF MOTOR	APPLICATION	TYPICAL SPECIFICATIONS
		POLYPHASE SQUIRREL CAGE INDUCTION MOTOR
		Indicate Option
	APPLICATION AND RATING	(rating) Horsepower (application) Motor shall be of the squirrel cage type
	CLASS	General Purpose—Normal Starting Torque, Normal Starting Current Class I—Linestart, Normal Starting Torque, Low Starting Current Class II—Linestart, High Starting Torque, Low Starting Current
	VOLTAGE	208, 220, 440, 550 volts
	PHASE	2, 3 phase
	FREQUENCY AND SPEED	25 cycles—1450, 725, 480 rpm 60 cycles—3500, 1750, 1150, 870, 575 rpm
	INSULATION	NEMA Class A insulation
	BEARINGS	Sleeve, Ball bearings
	ENCLOSURE	Open—40° C. continuous temperature rise Splash proof or drip proof—50° C. continuous temperature rise Fan-cooled totally enclosed—55° C. continuous temperature rise
	NOISE	Normal, Quiet operating
		Similar or equal to the Westinghouse CS motor and to conform to NEMA requirements.

Centrifugal Pumps
Compressors
Concrete Mixers
Conveyors
Elevators
Fans and Blowers
Line Shafting
Reciprocating Pumps
Stokers, and
all constant speed drives.



DIMENSIONS TYPE CS SQUIRREL-CAGE A.-C. MOTORS

Frame No.	H	W	L	Weight
W-204	9 ⁷ / ₈	10	15	105
W-224	11	11	16 ³ / ₄	145
W-225	11	11	17 ¹ / ₂	165
W-254	12 ¹ / ₂	12 ¹ / ₂	20	185
W-284	14	14	22 ⁵ / ₈	256
W-324	16	16	25 ⁵ / ₈	345
W-326	16	16	27 ¹ / ₄	385
W-364-S	17 ⁷ / ₈	18	26 ¹ / ₄	418
W-364	17 ⁷ / ₈	18	28 ¹ / ₂	536
W-365-S	17 ⁷ / ₈	18	27 ¹ / ₂	536
W-365	17 ⁷ / ₈	18	29 ¹ / ₂	723
W-404-S	19 ¹⁵ / ₁₆	20	29 ¹ / ₂	643
W-404	19 ¹⁵ / ₁₆	20	31 ¹ / ₈	733
WR-405-S	19 ¹⁵ / ₁₆	20	30 ⁵ / ₈	723
W-405	19 ¹⁵ / ₁₆	20	33 ¹ / ₄	993
W-444-S	21 ¹⁵ / ₁₆	22	33 ⁵ / ₈	941
W-444	21 ¹⁵ / ₁₆	22	36 ¹ / ₂	1042
W-445-S	21 ¹⁵ / ₁₆	22	35 ⁵ / ₈	1042
W-445	21 ¹⁵ / ₁₆	22	37 ¹ / ₂	1400
W-504-S	25 ¹ / ₈	25	40 ¹¹ / ₁₆	1400
W-504	25 ¹ / ₈	25	39 ¹ / ₁₆	1534
W-505-S	25 ¹ / ₈	25	43 ¹ / ₁₆	1534
W-505	25 ¹ / ₈	25	43 ¹ / ₁₆	1534

"S" suffix on frame denotes short length, small diameter shaft for coupled service.

TYPE CS SQUIRREL-CAGE GENERAL PURPOSE MOTORS* OR LINESTART CLASS 1 MOTORS

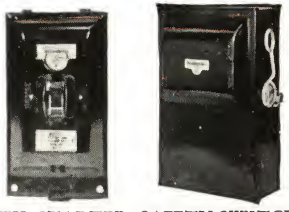
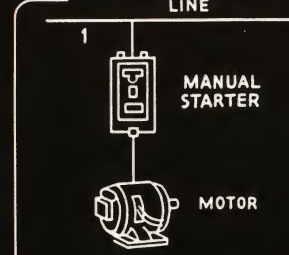
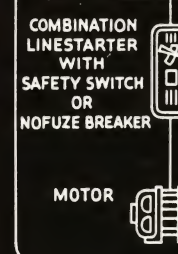
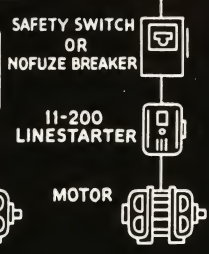
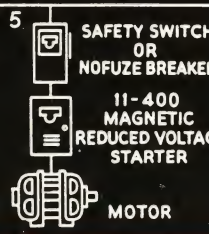
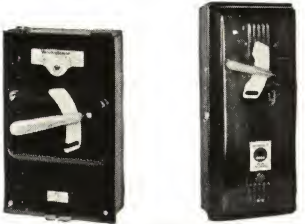
Hp.	Approx. Full Load Kpm, 220 V, 3 Phase	Approx. Full Load Amps, 220 V, 3 Phase	Frame No.	Hp.	Approx. Full Load Kpm, 220 V, 3 Phase	Approx. Full Load Amps, 220 V, 3 Phase	Frame No.
1 ¹ / ₂	870	2.2	W-204	20	3450	50.7	W-326
3 ¹ / ₄	1160	2.7	W-204		1745	49.2	W-364
1	860	2.9	W-224		1160	49.3	W-404
	1720	3.2	W-204		880	51.8	W-405
	1160	3.5	W-204	25	3450	64.5	W-364-S
	870	3.8	W-225		1740	59.3	W-365
1 ¹ / ₂	3500	4.1	W-204		1165	62.2	W-405
	1730	4.3	W-224		885	64.8	W-444
	1145	4.5	W-224	30	3500	72.0	W-365-S
	870	6.0	W-254		1730	70.1	W-405
2	3490	5.6	W-224		1170	74.1	W-444
	1720	5.7	W-225		880	74.0	W-445
	1145	5.9	W-225	40	3500†	100.0	WR-404-S
	870	7.3	W-254		1765	94.0	W-444
3	3450	8.3	W-224		1170	97.0	W-445
	1710	8.0	W-225		855	100.2	W-504
	1145	8.9	W-254	50	3500†	122.0	WR-405-S
	875	9.5	W-284		1755	114.0	W-445-S
5	3460	12.4	W-225		1150	118.2	W-504
	1740	12.8	W-254		875	122.6	W-505
	1145	14.0	W-284	60	3500†	...	W-444-S
	875	14.6	W-324		1750	139.2	W-504-S
7 ¹ / ₂	3480	19.8	W-254		1160	143.4	W-504
	1745	19.0	W-284		870	149.0	WL-607
	1165	20.2	W-324	75	3500†	...	W-445-S
	870	21.0	W-326		1750	174.0	W-505-S
10	3500	25.3	W-284		1160	171.0	WL-607
	1745	24.9	W-324		870	179.0	752-C
	1165	26.0	W-326	100	3500†	...	W-504-S
	880	28.4	W-365		1750	224.0	WL-607-S
15	3450	37.9	W-324		1160	232.0	752-S
	1759	36.0	W-326		870	242.0	754-C
	1160	37.6	W-365				
	880	40.5	W-404				

†These ratings are built only in Linestart Class I type.

*General Purpose Motors built in frames W-405 and smaller (30 hp. and smaller) are the same as Linestart Class I motors. These motors have normal starting torque and low starting current characteristics.



CONTROL FOR POLYPHASE SQUIRREL-CAGE A. C. MOTORS

CONTROL REQUIRED	HOOK-UP	TYPICAL SPECIFICATIONS
 WK STARTER SAFETY SWITCH	OPTIONAL ARRANGEMENTS ACROSS-THE-LINE STARTING  PUSH BUTTON STARTING OPTION 2  OPTION 3  REDUCED VOLTAGE STARTING OPTION 4  OPTION 5 	Control for Squirrel Cage..... (Fan, Pump, etc.) Motors shall consist of an enclosed: SPECIFICATION E manual three pole across-the-line starter and shall provide thermal overload protection to the motor. Control to be Westinghouse Type WK-16 or equal. SPECIFICATION F manual autotransformer type reduced voltage starter shall provide low voltage and thermal overload protection to the motor. Control to be Westinghouse Class 10-700 or approved equal. SPECIFICATION G magnetic resistance type reduced voltage starter, arranged to provide time limit acceleration, thermal overload protection and low voltage protection. To be pushbutton operated. Cabinet to be of the wall mounting ventilated type. Control to be Westinghouse Class 11-400 or approved equal. SPECIFICATION H magnetic across-the-line starter. To be push-button operated and arranged to provide thermal overload and low voltage protection. Control to be Westinghouse Class 11-200 or approved equal. SPECIFICATION I combination across-the-line type consisting of a 3 pole Nofuze circuit breaker assembled and wired in a common enclosure with a 3 pole magnetic across-the-line starter, arranged to provide thermal overload and low voltage protection. Control to be Westinghouse Class 11-206 or approved equal.
 NOFUZE BREAKER COMBINATION LINESTARTER		 DE-ION LINESTARTER AUTOSTARTER

ACROSS-THE-LINE STARTERS

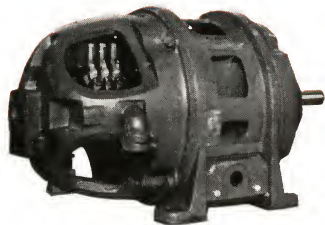
Max. Hp.—3 Phase		Manual Starters					Magnetic Starters									
		Motor Watchman					De-ion Linestarters					Combination De-ion Linestarter and "AB" Breaker				
							Type	Width	Height	Depth	Wt.	Type	Width	Height	Depth	Wt.
220 V.	440-500V.	Type	Width	Hgt.	Depth	Wt.	Type	Width	Height	Depth	Wt.	Type	Width	Height	Depth	Wt.
2	2	WK-18	5 ¼	9 ⅝	4 ⅜	7	11-200-S1	6 ⅝	8 ⅞	4 ¾	9	11-206-S1	8 ⅝	20 ⅝	6 ⅞	30
5	7 ½	WK-16	5 ¼	9 ⅝	4 ⅜	9	11-200-S1	6 ⅝	8 ⅞	4 ¾	9	11-206-S1	8 ⅝	20 ⅝	6 ⅞	30
15	25	.....	.....	.....	.....	.....	11-200-S2	12	17 ¼	6 ½	12	11-206-S2	12 ¾	27 ½	7 ⅞	72
30	50	.....	.....	.....	.....	.....	11-200-S3	14 ⅝	20	7 ⅞	51	11-206-S3	15	31 ⅜	7 ⅞	100
50	100	.....	.....	.....	.....	.....	11-200-S4	14 ⅝	24 ½	9 ½	110	11-206-S4	16	43	10	250

REDUCED VOLTAGE STARTERS

Manual Starters						Magnetic Starters						
Manual Auto Starters—Class 10-700						Resistance Type Magnetic Starters—Class 11-400						
Type A—Max. Hp.		Width	Height	Depth	Weight	Max. Hp.		Type	Width	Height	Depth	Weight
220 V.	440-550 V.					220 V.	440 V.					
5-10	5-10	17¾	19½	13¾	150	5	7½	11-400-S1	18½	29	17¾	140
15-30	15-30	19	21½	16¾	150	15	25	11-400-S2	18½	29	17¾	175
40-50	40-50	22¾	23¾	19½	200	30	50	11-400-S3	22½	33	17¾	225
....	60-100	25½	25½	21¼	350	50	100	11-400-S4	22½	33	21½	300
60-100	125-200	27½	28¾	21¾	400							



POLYPHASE WOUND ROTOR MOTORS



TYPE CW WOUND-ROTOR MOTORS

WHAT THEY ARE—Type CW Motors are similar to CS Motors except that they have wound rotors and slip rings instead of squirrel-cage rotors. (Sometimes they are called slip ring motors.) This permits speed variation and a heavier starting torque with lower starting current.

SIZES—1 to 200 hp. Usual applications are from 1 to 50 hp.

STANDARD VOLTAGES—Same as for CS Motor.

STANDARD FREQUENCIES—25, 50, 60 cycles. Use CW Motors for driving loads that are especially heavy to start, and where speed variation is required.

APPLICATION

Centrifugal
Pumps
Compressors
Conveyors
Fans and
Blowers
Line Shafting
Reciprocating
Pumps
Stokers, etc.

In general, same applications as for Type CS. Type CW Motors should be used instead of CS where (1) speed variation is required (2) driven machine requires heavy starting torque with exceptionally low starting current, such as reciprocating pumps or compressors and (3) Power companies' requirements call for wound-rotor motors because of low starting current inrush.

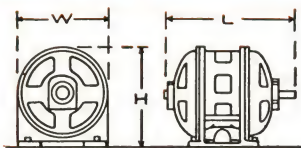
TYPICAL SPECIFICATIONS

POLYPHASE WOUND ROTOR
INDUCTION MOTORS

Indicate Option

APPLICATION AND RATING	(rating) Horsepower (application) Motor shall be of the Wound Rotor Induction type
VOLTAGE	208, 220, 440, 550 volts
PHASE	{ 2, 3 phase
FREQUENCY AND SPEED	{ 25 cycles—1450, 725, 500 rpm 60 cycles—3500, 1750, 1150, 870, 575 rpm
BEARINGS	{ Sleeve bearings Ball
ENCLOSURE	{ Open—40° C. continuous tem- perature rise Splash proof—50° C. contin- uous temperature rise
NOISE	{ Normal operating Quiet
INSULATION	NEMA Class A

Similar or equal to the Westinghouse type CW motor and to conform to the NEMA Standards.



DIMENSIONS, TYPE CW WOUND
ROTOR MOTORS

Frame No.	H	W	L	Weight
W-204	9 ⁷ / ₈	10	17	105
W-224	11	11	19 ¹ / ₂	145
W-225	11	11	20 ¹ / ₄	165
W-254	12 ¹ / ₂	12 ¹ / ₂	24 ¹ / ₄	185
W-284	14	14	26 ¹ / ₂	256
W-324	16	16	29 ¹ / ₂	340
W-326	16	16	31 ¹ / ₂	384
W-364	17 ⁷ / ₈	18	34 ⁷ / ₈	418
W-365	17 ⁷ / ₈	18	35 ⁷ / ₈	536
WR-404	19 ¹ / ₂	20	38 ¹ / ₂	643
W-404	19 ¹ / ₂	20	38 ¹ / ₂	643
WR-405	19 ¹ / ₂	20	39 ¹ / ₂	703
W-405	19 ¹ / ₂	20	39 ¹ / ₂	733
WR-444	21 ¹ / ₂	22	43 ¹ / ₂	950
W-444	21 ¹ / ₂	22	43 ¹ / ₂	941
WR-445	21 ¹ / ₂	22	45 ¹ / ₂	1060
W-445-S	21 ¹ / ₂	22	42 ¹ / ₂	1042
W-445	21 ¹ / ₂	22	45 ¹ / ₂	1042
W-504-S	25 ¹ / ₂	25	45 ¹ / ₂	1400
W-504	25 ¹ / ₂	25	49 ¹ / ₂	1400
W-505-S	25 ¹ / ₂	25	47 ¹ / ₂	1539
W-505	25 ¹ / ₂	25	52	

"S" suffix on frame denotes short length, small diameter shaft for coupled service.

RATINGS AND CAPACITIES, TYPE CW MOTORS

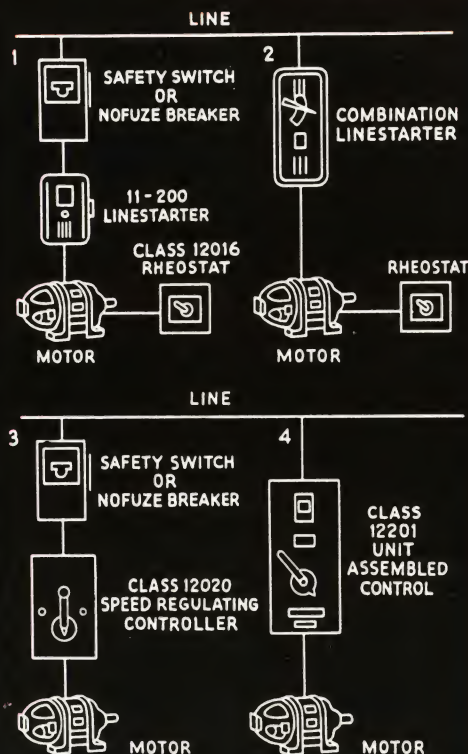
Hp.	Full Load Rpm, 220 V, 3 Phase	Approx. Full Load Primary Amps, per Terminal 220 V, 3 Phase	Frame No.	Hp.	Full Load Rpm, 220 V, 3 Phase	Approx. Full Load Primary Amps, per Terminal 220 V, 3 Phase	Frame No.
1/2	1110	2.2	W-204	20	1740	50.6	W-364
	825	2.6	W-204		1160	52.5	WR-404
3/4	1070	3.0	W-204		870	54.4	WR-405
	825	3.6	W-224		695	59.8	W-445
1	1650	4.2	W-204		575	65.0	W-504
	1100	4.5	W-204	25	1740	62.9	W-365
	825	5.0	W-225		1170	67.4	WR-405
			W-254		860	66.6	WR-444
1 1/2	1650	5.5	W-224		695	74.8	W-504
	1100	5.6	W-224		575	76.8	W-505
	860	6.0	W-254	30	1720	74.2	W-405
			W-254		1155	78.6	W-444
2	1650	7.0	W-225		870	80.6	WR-445
	1100	7.2	W-225		695	91.6	W-505
	845	8.3	W-254		570	90.6	W-505-C
			W-324	40	1765	96.0	W-444
3	1650	10.3	W-225		1160	103.8	WR-445
	1110	10.3	W-254		860	112.4	W-504
	850	11.7	W-284		690	117.0	WL-607
	685	12.6	W-326		580	120.5	752-C
	565	11.8	W-365	50	1760	118.4	W-445-S
5	1695	14.3	W-254		1145	132.0	W-504
	1125	15.8	W-284		860	148.0	W-505
	864	16.8	W-324		690	187.0	752-C
	695	20.3	W-365		580	158.0	754-C
	575	18.2	W-404	60	1755	139.5	W-504-S
7 1/2	1704	20.3	W-284		1160	146.0	W-505
	1140	34.5	W-324		870	152.2	WL-607
	870	23.4	W-326		700	161.5	754-C
	700	25.6	WR-404		575	173.0	774-C
	565	30.0	W-405	75	1755	180.0	W-504-S
	1745	26.6	W-324		1165	186.0	WL-607
	1147	28.5	W-326		870	186.6	752-C
	850	29.6	W-365		695	197.0	754-C
	695	32.1	WR-405		575	208.0	774-C
	560	35.0	W-444	100	1755	229.0	WL-607-S
15	1740	38.1	W-326		1175	238.0	752-S
	1145	41.4	W-365		870	249.0	754-C
	860	44.0	WR-404		695	254.0	854-C
	675	47.0	W-444		585	264.0	856-C
	577	49.7	W-445				



CONTROL FOR POLYPHASE WOUND ROTOR MOTORS

HOOK-UP

OPTIONAL ARRANGEMENTS



TYPICAL SPECIFICATIONS

SPECIFICATION J

Control for Wound Rotor.....Motors shall consist of (Fan, Pump, etc.) an enclosed 3 pole across-the-line magnetic primary starter with thermal overload and low voltage protection and a separately enclosed speed regulating secondary rheostat. Primary and secondary control shall be so interlocked as to provide complete control from the rheostat handle. Control to be Westinghouse Class 11-200 and Class 12-016 or approved equal.

SPECIFICATION K

(The same as Specification J with the exception that the primary starter and secondary rheostat are to be in the same cabinet. Control to be Westinghouse Class 12-020 or approved equal.)

SPECIFICATION L

Control for Wound Rotor.....Motors shall consist of (Fan, Pump, etc.) a 3 pole breaker assembled and wired in a common enclosure with a 3 pole magnetic primary starter arranged to provide thermal overload and low voltage protection, and a separately enclosed speed regulating secondary rheostat. Primary and secondary control shall be interlocked to provide complete control from the rheostat handle. Breaker handle shall be trip-free and indicate open, closed, and "tripped" positions. Control shall be Westinghouse Class 11-206 and Class 12-016 or approved equal.

SPECIFICATION M

Same as Specification L except that breaker, starter and secondary rheostat are all enclosed in a ventilated steel cabinet for floor mounting and with provision for locking the breaker in open or closed position. Door is to be interlocked with the breaker locking device to prevent opening when the breaker is in locked position.

Control shall be Westinghouse Class 12-201 or approved equal.

CONTROL DATA

Magnetic Primary Control—Ratings, Illustrations and Dimensions for Class 11-200 De-ion Line Starters and Class 11-206 Combination Linestarters are given on Page 29

Class 12-016—Speed Regulating Secondary Rheostats

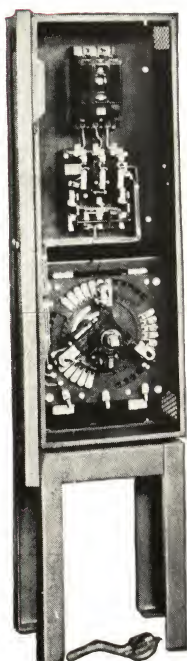
Hp.	Dimensions in Inches			Weight
	Width	Height	Depth	
1- 3	16 1/2	20	14 1/2	45
5- 7 1/2	16 1/2	17 3/8	17 5/8	70
10-25	14 1/2	23 1/2	20 1/4	90

Class 12-020—Combination Magnetic Primary and Manual Secondary Rheostat

Hp. 220-440 V.	Dimensions in Inches			Weight
	Width	Height	Depth	
5	14 1/2	30 1/8	20	90
7 1/2	14 1/2	30 1/8	20	100
10	14 1/2	30 1/8	20	100
15	16 1/2	34 1/8	20	130
20	16 1/2	34 1/8	20	130
25	16 1/2	34 1/8	20	130

Class 12-201—Combination Nofuze Disconnect Breaker, Magnetic Primary and Manual Secondary Rheostat

Hp. 220-440 V.	Dimensions in Inches			Weight
	Width	Height	Depth	
5	14 3/8	42 3/4	18	150
7 1/2	19 1/4	54	17 3/8	165
10	19 1/4	54	17 3/8	165
15	19 1/4	54	17 3/8	195
20	19 1/4	54	20	195
25	19 1/4	54	20	195



CLASS 12-201
OPEN VIEW



CLASS 12-020

DIRECT-CURRENT MOTORS



TYPE SK D-C. GENERAL PURPOSE MOTORS

WHAT THEY ARE—These are considered the most popular general purpose direct-current motors on the market. Their popularity is due to their splendid operating characteristics and excellence of design together with quality of materials used.

SIZES—From 1 to 200 hp. As a rule general purpose applications fall between 1 and 50 hp.

WHERE TO USE—Use SK motors where direct-current power is available. Use shunt wound SK motors where constant speed loads and fine speed adjustment over a wide range is required. Use compound SK motors for driving varying speed loads (that is speed drops with increased load) that are especially heavy to start. Series wound motors are also used where varying speeds and loads are encountered, but they must always be directly coupled to the load that never becomes less than 25% at the normal operating condition because increased speed will become dangerous at lighter loads.

ADAPTABILITY—Readily adaptable for drip-proof, splash-proof, semi-enclosed, self-ventilated or fan-cooled, force-ventilated and pipe-ventilated enclosures.

APPLICATION

Blowers

Compressors

Conveyors

Elevators

Fans

Ice Machines

Laundry

Equipment

Pumps

Refrigerating

Equipment

and any ap-

plication

where d-c.

power is

available.

TYPICAL SPECIFICATIONS

DC GENERAL PURPOSE MOTOR

Indicate Option

APPLICATION
AND RATING(rating) Horsepower (application)
Motor shall be of the industrial
direct current type

WINDING

{Compound
Shunt
Series} woundVOLTAGE
INSULATION.....volts direct-current
NEMA Class A

SPEED

{ 575
690
850
1150
1750 } r.p.m. at full load

BEARING

{Sleeve
Ball} bearing

ENCLOSURE

{Open
Drip-proof
Splash proof
Semi-enclosed
Totally enclosed fan-cooled

NOISE

{Normal
Quiet} operating

Similar or equal to the Westinghouse type SK motor and to conform to NEMA requirements.

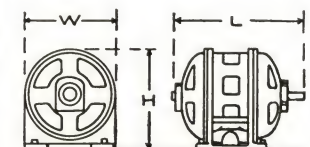
TYPE SK. DIRECT-CURRENT MOTORS, SHUNT WOUND, CONSTANT SPEED

Hp.	Volts	Full Load, r.p.m.	Max. Speed*	Frame No.	Net Wt.	Full load, amps.	Hp.	Volts	Full Load, r.p.m.	Max. Speed*	Frame No.	Net Wt.	Full load, amps.	Hp.	Volts	Full Load, r.p.m.	Max. Speed*	Frame No.	Net Wt.	Full load, amps.
¾	115	1150	2300	W-204	85	6.6	3	115	1750	2190	F-225	165	23	15	115	1750	2190	63	540	112
		850	1700	W-224	120	6.6			1150	2300	254	195	26			1150	1725	83	745	113
		1150	2300	W-204	85	3.3			850	1700	284	260	24			850	1700	93	840	112
		850	1700	W-224	120	3.3			575	1150	43	445	25			575	1150	113	1100	113
		1750	2190	W-204	85	8.4			1750	2190	F-225	165	11.8			1750	2190	63	540	55.6
		1150	2300	W-204	85	8.5			1150	2300	254	195	12.6			1150	1725	83	745	55.3
	230	850	1700	W-225	140	8.6		230	850	1700	284	260	12.6		230	850	1700	93	840	56
		1750	2190	W-204	85	4.2			575	1150	43	445	12.6			575	1150	113	1100	56
		1150	2300	W-204	85	4.2			1750	2190	254	195	40			1750	2190	83	745	160
		850	1700	W-225	140	4.3			1150	2300	284	260	40			1150	1725	93	840	148
		1750	2190	W-204	120	1.76		5	850	1700	43	445	36.6		20	1150	1700	103	1000	150
		1150	2300	W-204	120	1.78			575	1150	63-A	540	38			575	1150	123	1300	150
1½	115	1750	2190	W-224	120	12.3			1750	2190	254	196	20		230	1750	2190	83	745	75
		1150	2300	W-224	120	12.6			1150	2300	284	260	20			1150	1725	93	840	74
		850	1700	W-224	120	12.6			850	1700	43	445	19.1			850	1700	103	1000	73.5
		575	1150	284	260	12.6			575	1150	63-A	540	19			575	1150	123	1300	74.5
		1750	2190	W-224	120	6.2		7½	1750	2190	284	260	56.3		25	1750	2190	93	840	181
		1150	2300	W-224	195	6.3			1150	1725	43	445	56.4			1150	1725	103	1000	182
2	230	850	1700	W-224	195	6.3			850	1700	63	530	56		230	850	1700	113	1000	185
		575	1150	284	260	6.4			575	1150	83	745	56.4			575	1150	133	1600	184
		1750	2190	W-225	140	16.0			1750	2190	284	260	29			1750	2190	83	745	91.5
		1150	2300	F-225	165	16.2		10	1150	1725	43	445	28.2		230	1150	1725	103	1000	91.7
		850	1700	254	195	16.0			850	1700	63	530	29			850	1700	113	1100	92
		575	1150	284	260	16.0			575	1150	83	745	29			575	1150	133	1600	92
	115	1750	2190	W-225	140	8			1750	2190	43	445	75.9			1750	2190	83	745	91.5
		1150	2300	F-225	165	8			1150	1725	63	530	75.4			1150	1725	103	1000	91.7
		850	1700	254	195	8		230	850	1700	83	745	75			850	1700	113	1100	92
		575	1150	284	260	8			575	1150	93	840	75.5			575	1150	133	1600	92
		1750	2190	W-225	140	8			1750	2190	43	445	37.5			1750	2190	83	745	91.5
		1150	2300	F-225	165	8			1150	1725	63	530	37.5			1150	1725	103	1000	91.7
	230	850	1700	254	195	8			850	1700	83	745	38			850	1700	113	1100	92
		575	1150	284	260	8			575	1150	93	840	38			575	1150	133	1600	92

*By field control.

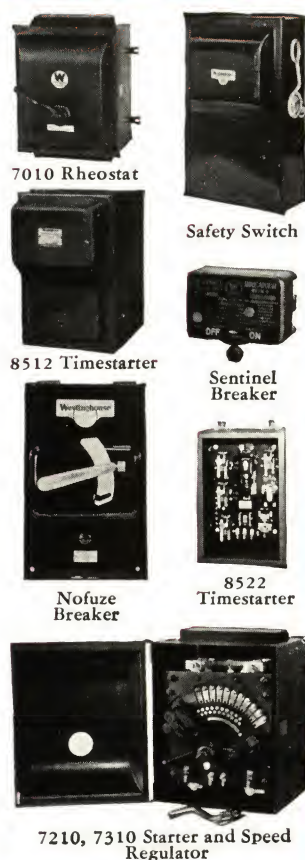
DIMENSIONS IN INCHES, TYPE SK. D-C. MOTORS

Frame No.	H.	W.	L.	Shpg. Wt.	Frame No.	H.	W.	L.	Shpg. Wt.
W204	9⅞	10	17	95	63	18⅞	19	34⅞	625
W224	11	11	19⅞	145	83	22⅞	23	36⅞	820
F225	11	11	21⅞	185	93	22⅞	23⅞	38	918
W225	11	11	20⅞	165	103	25⅞	26⅞	39⅞	1090
254	12⅞	12⅞	24⅞	215	113	25⅞	26⅞	40⅞	1185
284	14	14	26⅞	285	123-L	28⅞	28⅞	44⅞	1445
43	17⅞	18⅞	32⅞	490	123	28⅞	28⅞	42⅞	1420
63-A	18⅞	19	34⅞	630	133	30⅞	29	45⅞	1825

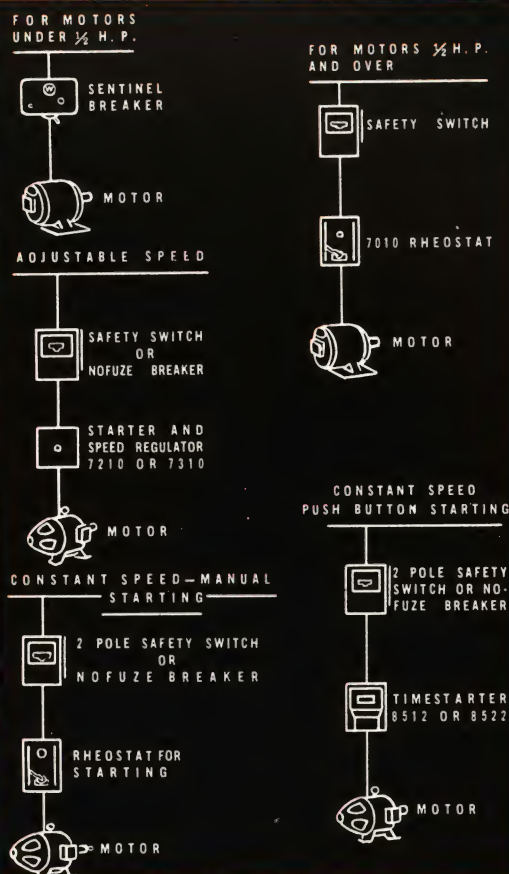


CONTROL FOR DIRECT CURRENT MOTORS

CONTROL REQUIRED



HOOK-UP



TYPICAL SPECIFICATION

SPECIFICATION M

Control for Constant Speed DC.....
(Fan, Pump, etc.)
Motors shall consist of an enclosed manually operated rheostatic controller for starting duty only and to include a self-contained NEMA class 114 resistor. A low voltage device is to be provided to latch the Rheostat operating Handle in the Run position, on normal voltage. Control to be Westinghouse Class 7010 or approved equal.

SPECIFICATION N

Control for Constant Speed DC.....
(Fan, Pump, etc.)
Motors shall consist of an enclosed magnetic controller and resistors for starting duty only. The controller is to be push-button operated and is to provide thermal overload and low voltage protection and definite time limit acceleration. Control to be Westinghouse Class 8512B, 8513B, 8522B or approved equal.

SPECIFICATION O

Control for Variable Speed DC.....
(Fan, Pump, etc.)
Motors shall consist of an enclosed manually operated rheostatic controller and resistors arranged to provide 25% speed increase by field control from a common operating mechanism. The controller is to be provided with a low voltage release device which will return the rheostat handle to the "off" position in case of voltage failure. Control to be Westinghouse Class 7210 or approved equal.

Manual Control

Face Plate Starters and Speed Regulators

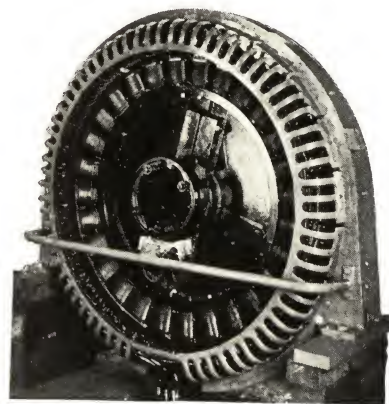
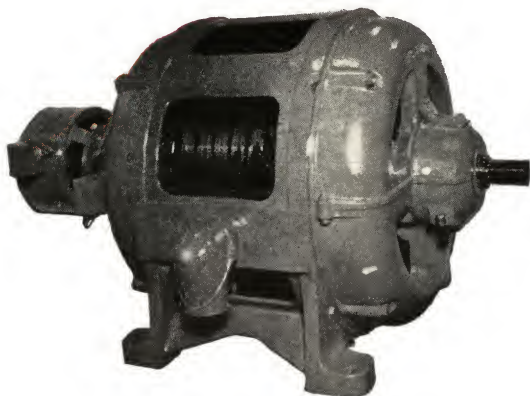
Hp.		Starters Class 7010				Sp. Regulators, Field Cont. Class 7210				Sp. Regulators, Armature Cont. Class 7301			
		Dimensions in Inches			Weight	Dimensions in Inches			Weight	Dimensions in Inches			Weight
		Width	Height	Depth		Width	Height	Depth		Width	Height	Depth	
115 V.	230 V.												
$\frac{1}{4}$ to $\frac{1}{2}$	$\frac{1}{4}$ to $\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{3}{4}$	$3\frac{3}{4}$	5	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$16\frac{1}{2}$	20	$14\frac{1}{4}$	60
$\frac{3}{4}$ to 2	$\frac{3}{4}$ to 2	$7\frac{1}{2}$	9	8	15	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$16\frac{1}{2}$	20	$14\frac{1}{4}$	60
.....	3	$7\frac{1}{2}$	9	8	18	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$16\frac{1}{2}$	$17\frac{3}{8}$	$17\frac{3}{8}$	80
3	5 to $7\frac{1}{2}$	12	$14\frac{1}{4}$	$11\frac{3}{8}$	35	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$16\frac{1}{2}$	$17\frac{3}{8}$	$17\frac{3}{8}$	80
5-10	10	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$16\frac{1}{2}$	$17\frac{3}{8}$	$17\frac{3}{8}$	120
.....	15-20	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$18\frac{5}{8}$	$23\frac{1}{2}$	$20\frac{1}{4}$	130
.....	25	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$16\frac{1}{2}$	20	$14\frac{1}{4}$	50	$18\frac{5}{8}$	$23\frac{1}{2}$	29	150
15-25	30-50	$20\frac{1}{2}$	24	$14\frac{1}{4}$	80	$20\frac{1}{2}$	24	$17\frac{3}{4}$	90	$18\frac{5}{8}$	$23\frac{1}{2}$	29	250

Magnetic Control

D-C. Magnetic Timestarters

Class	115 V.	Horsepower		Dimensions in Inches			Weight
		230 V.	550 V.	Width	Height	Depth	
8512-B2	1 to 5	1 to 10	1 to 7 1/2	9	12 1/4	11 1/2	20
8513-B	1 to 7 1/2	1 to 7 1/2	1 to 7 1/2	9 15/16	9	12 3/8	60
8513-B	10	10 to 20	10 to 20	12 7/16	23	14 1/8	60
8522-B	15-20	25 to 40	25 to 40	17 1/4	28 3/8	14 1/2	185
8522-B	25-40	50 to 75	50 to 75	17 1/4	32 3/8	14 1/2	300
8522-B	50 to 75	100 to 150	100 to 150	19 1/4	32 3/8	18 1/2	300
8522-B				19 1/4	32 3/8	22 1/2	400
8522-B				27	66	18 3/4	850

SYNCHRONOUS MOTORS



APPLICATION

Synchronous motors afford a very economical means of improving power factor and efficiencies thereby reducing power costs. Type G general purpose synchronous motors, built in sizes as low as 20 horsepower, make these economies possible in even the smaller size plant or building and are supplied in ratings of 20 hp. and above in all commercial voltages and frequencies; 514 to 1800 r.p.m., 2 and 3 phase, 100% and 80%

power factor. Type HR 100 to 450 r.p.m., Low Speed Engine Type and Coupled Synchronous Motors for direct drive are admirably adapted for operating constant speed compressors and pumps and low speed fans. Synchronous motors are recommended for all types of constant speed machinery such as fans, blowers, compressors, pumps, etc.

FEATURES

POWER FACTOR CORRECTION—Synchronous motors make an excellent means of correcting and controlling power

factor. They can be furnished for any desired power factor—usually 100% or 80% leading at normal load.

HOW TO SELECT

First determine the amount of Power Factor correction that is desired. Then select the constant speed motor application

which will permit the use of a synchronous motor large enough to give the desired amount of power factor correction.

DIMENSIONS

Available when quotation is made for the special motor to give the desired PF. correction for the particular application.

TYPICAL SPECIFICATION

	Indicate Option		Indicate Option
	(rating) Horsepower (application) motor shall be of the Synchronous type	BEARINGS	{ Sleeve } bearings { Ball }
POWER FACTOR	{ 80% } power factor { 100% }	ENCLOSURE	{ Open Drip-proof covers Splash-proof covers Totally enclosed self ventilated Totally enclosed forced ventilated Enclosed collectors
VOLTAGE	volts (all commercial voltages available)	EXCITATION	{ Direct Connected Belted Motor Generator set } Exciter
PHASE	{ 2 } phase { 3 }	INSULATION	{ NEMA Class A Special moisture resisting insulation.
FREQUENCY	25, 50, 60 cycles		
TORQUE	Starting Torque—.....% full load torque Pull-in Torque—.....% full load torque Pull-out Torque—.....% full load torque		
Specify Each			

WHERE TO BUY

See your nearest Westinghouse District office for detailed information. Addresses of district offices given on the back cover.

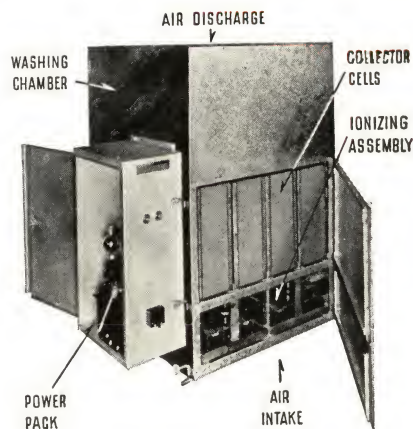


PRECIPITRON



Left: Field Bldg., Chicago.
First 5 floors, 16 Units
272,000 C.F.M. capacity.

Right: 300 C.F.M.
Industrial Unit.



APPLICATION

The Precipitron is a simple but highly efficient dust precipitator which, with a pressure drop not exceeding 1/10 inch of water, will remove more than 95% of all solid matter from air or gases regardless of the size of the particles. It is particularly adaptable for use with heating, ventilating, and air conditioning systems.

Mechanical filters will not remove particles smaller than .0025 inch in diameter without a prohibitive pressure drop. However, tests show that more than 80% of the dust particles in a normal atmosphere are smaller than .0025 inches in diameter. From the standpoint of damage the smaller particles of dust are as harmful as the larger. The same applies to smoke, pollen, bacteria and germs.

FEATURES

SIMPLE, COMPACT DESIGN. The PRECIPITRON is composed of three main parts, the power pack, the ionizing chamber, and the collector cells.

FLEXIBILITY—Standard size units can be assembled together to build up cleaners of various capacities. Installations have been made ranging from 300 C.F.M. to 272,000 C.F.M.

SAFETY—No exposed live parts, no appreciable generation of toxic or objectionable gases.

EFFICIENCY—If the rate of flow is not in excess of 375 lineal feet per minute practically all solid matter is removed.

ADAPTABILITY—Can be installed as part of air conditioning, heating or ventilating systems with little additional duct work.

HOW TO SELECT

Standard Units may be selected from the Table and assembled to form a complete cleaner of the required capacity. If your cleaning problem is one of removing ordinary atmospheric im-

purities, standard units are suitable. If your problem is a special one consult your nearest Westinghouse representative.

TYPICAL SPECIFICATIONS

The contractor shall furnish and install an air cleaner of the electrostatic type capable of cleaning _____ C.F.M. The velocity of air at any point in the cleaner shall not exceed 375 F.P.M. and the pressure drop through the cleaner shall not exceed 1/10 inch of water gauge. The efficiency shall not be less than 90% (Bureau of Standards Blackness Test) on normal atmospheric impurities.

The cleaner shall consist of standard collector cells, ionizing units, and Power Packs assembled and wired in line with the manufacturers' recommendations.

The contractor shall be responsible for all necessary duct, supporting, supporting frame, housing, drains, water supply connections for cleaning purposes, interlocks and wiring to conform with underwriters' specifications and the manufacturers' recommendations.

The cleaner shall be similar or equal to the Precipitron as manufactured by Westinghouse E. & M. Co.

DIMENSIONS

Name of Part	Capacity	Depth	Width	Height	Wgt.
Collector Cell (Cor-ten)	375-C.F.M.	19"	8 1/8"	17 3/4"	65
Collector Cell (Aluminum)	375-C.F.M.	19 1/8"	8 3/4"	18"	41
Ionizing Unit.....	2-Cell	6 5/16"	16 1/4"	17 3/4"	21
Ionizing Unit.....	3-Cell	6 5/16"	23 3/4"	17 3/4"	24
Collector Cell (Cor-ten) ...	550-C.F.M.	19"	8 3/8"	25 7/8"	87
Collector Cell (Aluminum)	550-C.F.M.	19 1/8"	8 3/4"	25 7/8"	55
Ionizing Unit.....	2-Cell	6 5/16"	16 1/4"	25 7/8"	28
Ionizing Unit.....	3-Cell	6 5/16"	23 3/4"	25 7/8"	32
Collector Cell (Cor-ten) ...	750-C.F.M.	19"	8 3/8"	35 7/8"	130
Collector Cell (Aluminum)	750-C.F.M.	19 1/8"	8 3/4"	25 3/4"	75
Ionizing Unit.....	2-Cell	6 5/16"	16 1/4"	35 3/16"	34 1/2
Ionizing Unit.....	3-Cell	6 5/16"	23 3/4"	35 3/16"	40
Power Pack 85 watts.....	5-cell Cap.	14"	12 7/8"	26 3/8"	76
Power Pack 480 watts.....	40-cell Cap.	15"	22"	45"	325
Room Unit (self-contained)	300-C.F.M.	14"	36"	34"	220

WHERE TO BUY

Room Units Only—Consult Atmospheric Electric Filter Corp., Woolworth Building, New York City.
Industrial Applications for Processing only—Consult Pangborn Corporation, Hagerstown, Md.

For all air cleaning application consult your nearest Westinghouse representative. See list on back cover.
For additional information request copies of Leaflet F-8398, Instruction Book IB-5797 and I. B.-2706.



MOTOR BRANCH CIRCUIT PROTECTION

TABLE FOR SELECTING SWITCH, CIRCUIT BREAKER, WIRE AND FUSE SIZES FOR MOTOR BRANCH CIRCUITS
ADAPTED FROM 1935 N. E. CODE SEC. 808

Full load current rating of motor	Minimum allowable size of copper wire American gauge or Cir. Mil.	3 Non-fusible switch size for disconnect	Fusible switch or ABI Breaker size for disconnect Columns 5, 7 and 9 Maximum Rating of Branch Circuit Breaker Amperes Based on 20 Seconds Accelerating Time†								
			Squirrel-cage and synchronous (full-voltage, reactor and resistor starting). Single phase			Squirrel-cage and synchronous (auto-transformer starting). High-reactance squirrel-cage***			Wound Rotor A-C. and D-C.		
			4 Max. allowable rating of branch circuit fuses	5 Fusible Switch Circuit Breaker		6 Max. allowable rating of branch circuit fuses	7 Fusible Switch Circuit Breaker		8 Max. allowable rating of branch circuit fuses	9 Fusible Switch Circuit Breaker	
				Amp.	Amp.		Amp.	Amp.		Amp.	Amp.
1 Amp.	2 Rubber	Amp.	Amp.	Amp.	Amp.	Amp.	Amp.	Amp.	Amp.	Amp.	Amp.
1**	14	30	15	30	15	15	30	15	15	30	15
2**	14	30	15	30	15	15	30	15	15	30	15
3**	14	30	15	30	15	15	30	15	15	30	15
4**	14	30	15	30	15	15	30	15	15	30	15
5**	14	30	15	30	15	15	30	15	15	30	15
6**	14	30	20	30	15	15	30	15	15	30	15
7	14	30	25	30	15	20	30	15	15	30	15
8	14	30	25	30	20	20	30	20	15	30	15
9	14	30	30	30	20	25	30	20	15	30	15
10	14	30	30	30	25	25	30	20	15	30	20
11	14	30	35	60	25	30	30	25	20	30	20
12	14	30	40	60	25	30	30	25	20	30	20
13	12	30	40	60	35	35	60	35	20	30	25
14	12	30	45	60	35	35	60	35	25	30	25
15	12	30	45	60	35	40	60	35	25	30	25
16	12	30	50	60	35	40	60	35	25	30	25
17	10	30	60	60	50	45	60	35	30	30	35
18	10	30	60	60	50	45	60	35	30	30	35
19	10	30	60	60	50	50	60	35	30	30	35
20	10	30	60	60	50	50	60	35	30	30	35
22	8	30	70	100	50	60	60	50	35	60	35
24	8	30	80	100	50	60	60	50	40	60	50
26	8	60	80	100	50	70	100	50	40	60	50
28	8	60	90	100	50†	70	100	50	45	60	50
30	6	60	90	100	50†	70	100	50	45	60	50
32	6	60	100	100	70	70	100	50	50	60	50
34	6	60	110	200	70	70	100	70	60	60	70
36	6	60	110	200	70	80	100	70	60	60	70
38	6	60	125	200	70	80	100	70	60	60	70
40	6	60	125	200	70	80	100	70	60	60	70
42	5	60	125	200	70	90	100	70	70	100	70
44	5	60	125	200	70	90	100	70	70	100	70
46	4	60	150	200	70	100	100	70	70	100	70
48	4	60	150	200	90	100	100	90	80	100	90
50	4	60	150	200	90	100	100	90	80	100	90
52	4	100	175	200	90	110	200	90	80	100	90
54	4	100	175	200	90	110	200	90	90	100	90
56	4	100	175	200	90	120	200	90	90	100	90
58	3	100	175	200	90	120	200	90	90	100	90
60	3	100	200	200	90	120	200	90	90	100	90
62	3	100	200	200	100	125	200	100	100	100	100
64	3	100	200	200	100	150	200	100	100	100	100
66	2	100	200	200	100	150	200	100	100	100	100
68	2	100	225	400	125	150	200	125	110	200	125
70	2	100	225	400	125	150	200	125	110	200	125
72	2	100	225	400	125	150	200	125	110	200	125
74	1	100	225	400	125	150	200	125	125	200	125
76	1	100	250	400	125	175	200	125	125	200	125
78	1	100	250	400	125	175	200	125	125	200	125
80	1	100	250	400	125	175	200	125	125	200	125
82	0	200	250	400	125	175	200	125	125	200	125
84	0	200	250	400	150	175	200	150	150	200	150
86	0	200	300	400	150	175	200	150	150	200	150

**For the grouping of small motors under the protection of a single set of fuses, see Sec. 808 N. E. Code.

***High reactance squirrel-cage motors are those designed to limit the starting current by means of deep-slot secondaries or double-wound secondaries and are generally started on full voltage.

†Applications having unusually long starting period or frequent starting refer to works for proper size breaker. High ambients affect rating of breakers (ambients over 75°F. use a breaker rated one percent higher for each 5°F. For ambients under 75°F. you may use a breaker rated one percent lower for each 5°F. change. This rule applies over a range of 40°F. either way).

‡Does not allow more than 8 seconds starting time.



MOTOR BRANCH CIRCUIT PROTECTION (Continued)

TABLE FOR SELECTING SWITCH, CIRCUIT BREAKER, WIRE AND FUSE SIZES FOR MOTOR BRANCH CIRCUITS
ADAPTED FROM 1935 N. E. CODE SEC. 808

Full load current rating of motor	Minimum allowable size of copper wire American gauge or Cir. Mil.	3 Non-fusible switch size for disconnect	Fusible switch or ABI Breaker size for disconnect Columns 5, 7 and 9 Maximum Rating of Branch Circuit Breaker Amperes Based on 20 Seconds Accelerating Time†								
			Squirrel-cage and synchronous (full-voltage, reactor and resistor starting). Single phase			Squirrel-cage and synchronous (auto-transformer starting). High-reactance squirrel-cage***			Wound Rotor A-C. and D-C.		
			4 Max. allowable rating of branch circuit fuses	5 Fusible Switch	6 Circuit Breaker	7 Max. allowable rating of branch circuit fuses	8 Fusible Switch	9 Circuit Breaker	10 Max. allowable rating of branch circuit fuses	11 Fusible Switch	12 Circuit Breaker
1 Amp.	2 Ruler	3 Amp.	4 Amp.	5 Amp.	6 Amp.	7 Amp.	8 Amp.	9 Amp.	10 Amp.	11 Amp.	12 Amp.
88	0	200	300	400	150	200	200	150	150	200	150
90	0	200	300	400	150	200	200	150	150	200	150
92	0	200	300	400	150	200	200	150	150	200	150
94	0	200	300	400	150	200	200	150	150	200	150
96	0	200	300	400	150	200	200	150	150	200	150
98	0	200	300	400	150	200	200	150	150	200	150
100	0	200	300	400	150	200	200	150	150	200	150
105	00	200	350	400	175	225	400	175	175	200	175
110	00	200	350	400	175	225	400	175	175	200	175
115	00	200	350	400	175	250	400	175	175	200	175
120	00	200	400	400	200	250	400	200	200	200	200
125	000	200	400	400	200	250	400	200	200	200	200
130	000	200	400	400	200	300	400	200	200	200	200
135	000	200	450	600	200	300	400	200	225	400	200
140	000	200	450	600	225	300	400	225	225	400	225
145	200,000	200	450	600	225	300	400	225	225	400	225
150	200,000	200	450	600	225	300	400	225	225	400	225
155	200,000	200	500	600	275	350	400	275	250	400	275
160	200,000	200	500	600	275	350	400	275	250	400	275
165	0000	400	500	600	275	350	400	275	250	400	275
170	0000	400	500	600	275	350	400	275	300	400	275
175	0000	400	600	600	275	350	400	275	300	400	275
180	0000	400	600	600	275	400	400	275	300	400	275
185	250,000	400	600	600	300	400	400	300	300	400	300
190	250,000	400	600	600	300	400	400	300	300	400	300
195	250,000	400	600	600	300	400	400	300	300	400	300
200	250,000	400	600	600	300	400	400	300	300	400	300
210	300,000	400				450	600	325	350	400	325
220	300,000	400				450	600	325	350	400	325
230	350,000	400				500	600	400	350	400	400
240	350,000	400				500	600	400	400	400	400
250	400,000	400				500	600	400	400	400	400
260	400,000	400				600	600	400	400	400	400
270	500,000	400				600	600	450	450	600	450
280	500,000	400				600	600	450	450	600	450
290	500,000	400				600	600	450	450	600	450
300	500,000	400				600	600	450	450	600	450
320	500,000	400							500	600	500

*For the grouping of small motors under the protection of a single set of fuses see Sec. 808 N. E. Code.

***High reactance squirrel-cage motors are those designed to limit the starting current by means of deep-slot secondaries or double-wound secondaries and are generally started on full voltage.

†Applications having unusually long starting period or frequent starting refer to works for proper size breaker. High ambients affect rating of breakers (ambients over 75°F. use a breaker rated one % higher for each 5°F. For ambients under 75°F. you may use a breaker rating one % lower for each 5° change. This rule applies over a range of 40°F. either way.)

‡Does not allow more than 8 seconds starting time.

TABLE FOR SELECTING TYPE AB "DE-ION" BREAKERS FOR CONDUCTOR PROTECTION

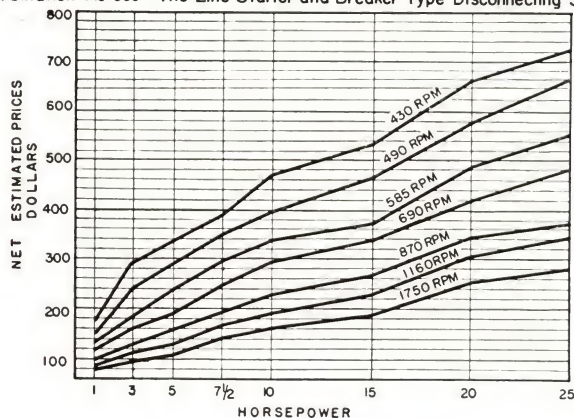
Gauge No.	Area in Circular Mils	BreakerSizeRubber InsulationAmperes	Gauge No.	Area in Circular Mils	BreakerSizeRubber InsulationAmperes
14	4,107	15	000	167,800	175
12	6,530	20		200,000	200
10	10,380	25	0000	211,600	225
8	16,510	35		250,000	250
6	26,250	50		300,000	275
5	33,100	50		350,000	300
4	41,740	70		400,000	325
3	52,630	70		500,000	400
2	66,370	90		600,000	450
1	83,690	100		700,000	500
0	105,500	125		750,000	500
00	133,100	150		800,000	550
				900,000	600



ESTIMATING PRICES

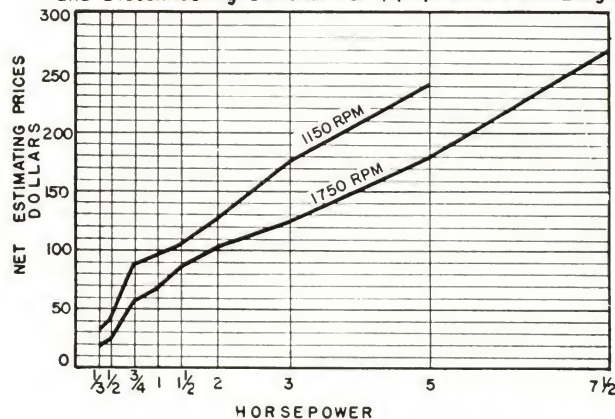
The following curves and tables are for use in estimating costs of apparatus only. The prices are net to users and are subject to change without notice.

Type "CS" a-c. Squirrel Cage, General Purpose, Constant Speed, 40°C, 60 Cycles, 2 and 3 Phase, 220-440 Volt Motor Including Combination Across-The-Line Starter and Breaker Type Disconnecting Switch.



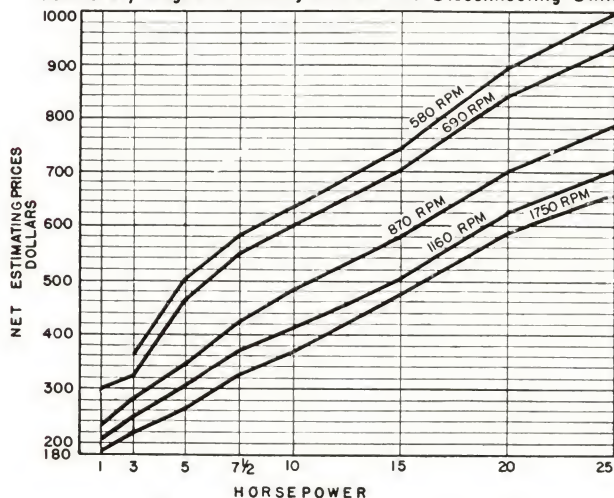
IF THE DESIRED RATING FALLS BETWEEN THOSE LISTED
USE THE NEXT HIGHER LISTED RATING

Repulsion-Start, Single-Phase, Constant Speed, 40°C, 110-220 Volt Induction Motor. Including Sentinel Breakers For ½-Hp. Motors and Under — Resistance Type Starters and Disconnecting Switches For ¾-Hp. Motors and Larger.



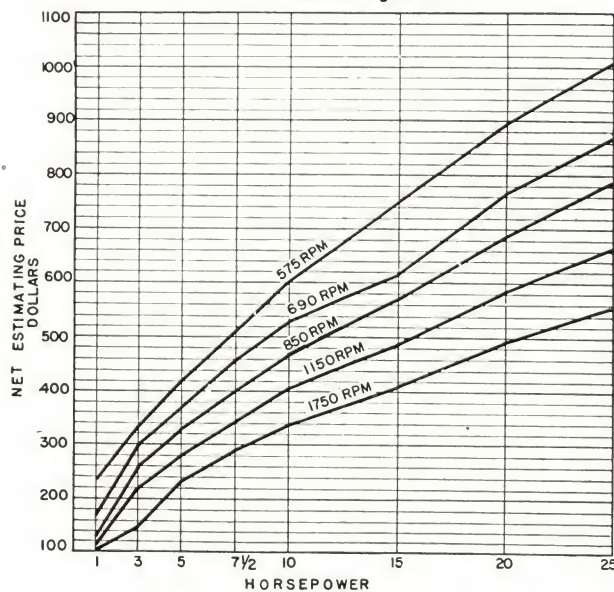
IF THE DESIRED RATING FALLS BETWEEN THOSE LISTED
USE THE NEXT HIGHER LISTED RATING

Type "CW" a-c. Wound Rotor, General Purpose, Open, Constant and Varying Speed, 2 and 3 Phase, 60 Cycles, 220-440 Volts 40°C Motor, Including Faceplate Type Speed Regulating Secondary Controller, Magnetic Primary Starter and Disconnecting Switch.



IF THE DESIRED RATING FALLS BETWEEN THOSE LISTED
USE THE NEXT HIGHER LISTED RATING

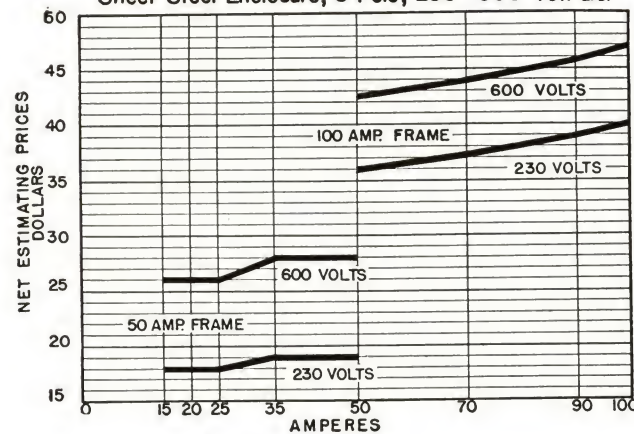
Type "SK" d-c. Shunt Wound, Constant Speed, Open, Horizontal, Sleeve Bearing 40°C 115-230 Volt Motor Including Manual Starting Rheostat Only, And Disconnecting Switch.



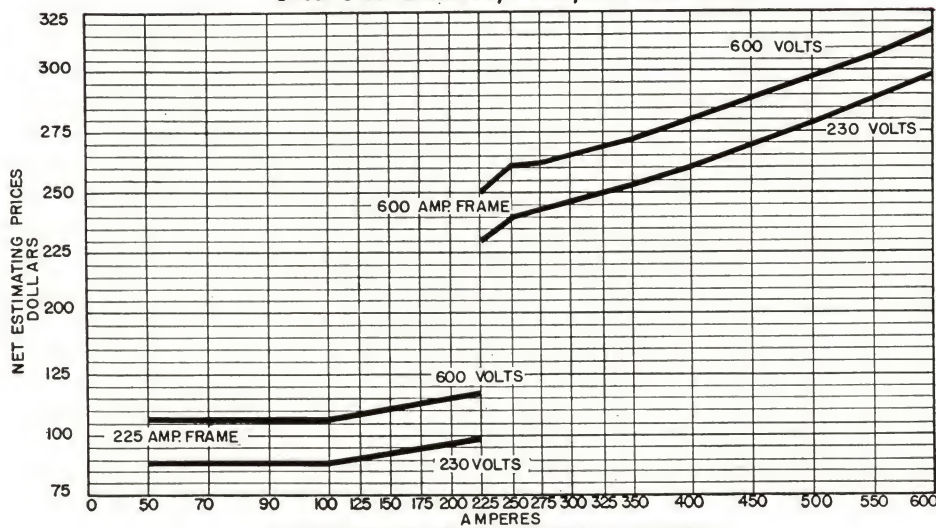
IF THE DESIRED RATING FALLS BETWEEN THOSE LISTED
USE THE NEXT HIGHER LISTED RATING



Type "ABI" Circuit Breakers, Dust Resisting
Sheet Steel Enclosure, 3 Pole, 230-600 Volt a.c.

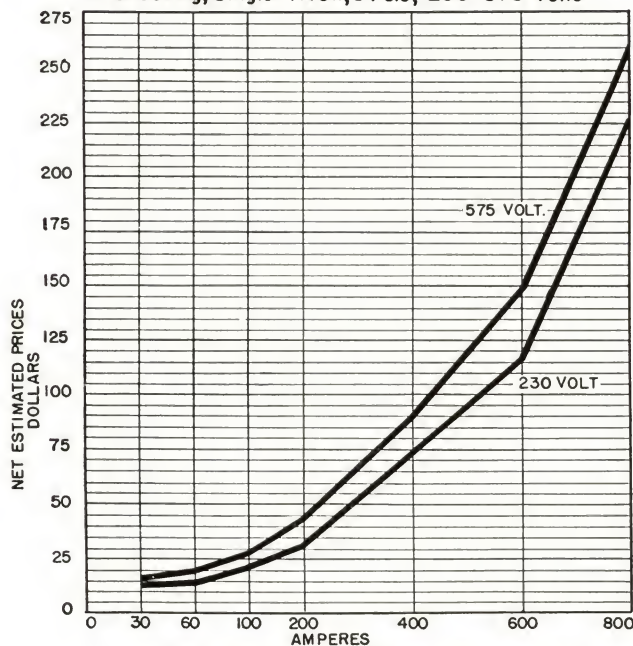


Type "ABI" Circuit Breaker, Dust Resisting
Sheet Steel Enclosure, 3 Pole, 230-600 Volt a.c.



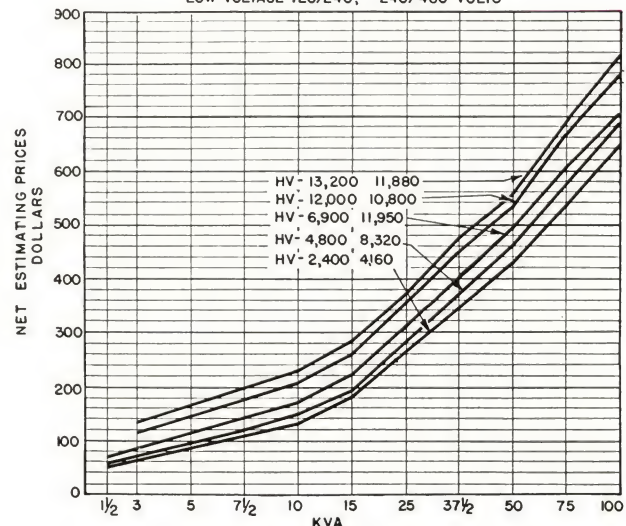
IF THE DESIRED RATING FALLS BETWEEN THOSE LISTED
USE THE NEXT HIGHER LISTED RATING

Type "A" Safety Switches, Fusible, Quick-Make and Quick-Break,
Interlocking, Single-Throw, 3 Pole, 230-575 Volts



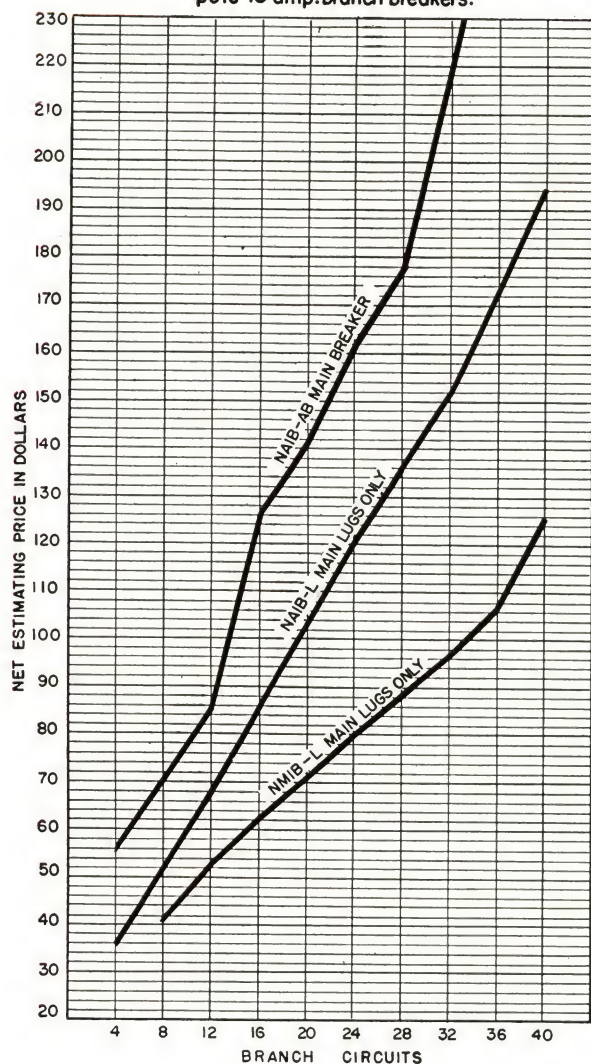
IF THE DESIRED RATING FALLS BETWEEN THOSE LISTED
USE THE NEXT HIGHER LISTED RATING

Conventional Distribution Transformers
SINGLE PHASE 60 CYCLES
LOW VOLTAGE 120/240, 240/480 VOLTS

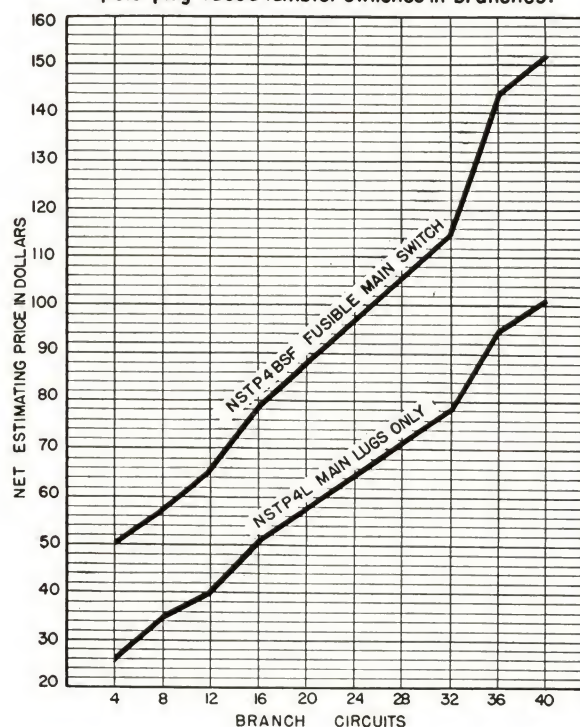


IF THE DESIRED RATING FALLS BETWEEN THOSE LISTED
USE THE NEXT HIGHER LISTED RATING.

NOFUZE Lighting Distribution Panelboards
Three-phase four-wire mains with single
pole 15 amp. branch breakers.



Fuse Type Lighting Distribution Panelboards,
Three-phase 4-wire mains with 15 amp. single
pole plug fused tumbler switches in branches.



NOFUZE CONVERTIBLE DISTRIBUTION PANELBOARD

Net Estimating Prices Only

Main Capacity.....	225 Amp.	400 Amp.	600 Amp.	800 Amp.	1000 Amp.
Base Price.....	\$26.00	\$49.00	\$ 70.00	\$113.00	\$140.00

Add for Each 250 Volt A-C. or 125 Volt D-C. Branch Breaker

Breaker Frame Size.....	50 Amp.	100 Amp.	225 Amp.	400 Amp.	600 Amp.
Price { 2 Pole Breaker.....	\$15.00	\$31.00	\$ 82.00	\$225.00	\$260.00
3 Pole Breaker.....	20.00	41.00	105.00	263.00	308.00

Add for Each 600 Volt A-C. or 250 Volt D-C. Branch Breaker

Price { 2 Pole Breaker.....	\$22.00	\$36.00	\$ 94.00	\$240.00	\$270.00
3 Pole Breaker.....	30.00	49.00	124.00	290.00	320.00

NOTE: If main breakers are desired figure as an additional branch of the same capacity.



WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

BUSINESS ADDRESSES

① Headquarters, Pittsburgh, Pa.

- *AKRON, OHIO, 106 South Main St.
 *ALBANY, N. Y., 456 No. Pearl St.
 §ALEXANDRIA, VA., 121 Frazier Ave.
 *ALLETOWN, PA., 522 Maple St.
 ①*APPLETON, WISC., 1708 N. Drew St., P. O. Box 206
 †APPLETON, WISC., 1029 So. Outagamie St.
 †*ATLANTA, GA., 426 Marietta St., N. W.
 xATTICA, N. Y.
 *BAKERSFIELD, CALIF., 2224 San Emedio St.
 †BALTIMORE, MD., 118 E. Lombard St.
 †BALTIMORE, MD., 501 East Preston Road
 §BALTIMORE, MD., 40 S. Calvert St.
 ①*BEAUMONT, TEXAS, 2293 Broadway Ave., P. O. Box 2367
 *BINGHAMTON, N. Y., Suite 704, Marine Midland Bldg., 86 Court St.
 *BIRMINGHAM, ALA., 2030 Second Ave.
 *BLUEFIELD, W. VA., 208 Bluefield Avenue
 §BOISE, IDAHO, P. O. Box 1597
 *BOSTON, MASS., 10 High St.
 †BOSTON, MASS., 12 Farnsworth St.
 †BRIDGEPORT, CONN., Bruce Ave. & Seymour St.
 *BUFFALO, N. Y., 814 Ellicott Square
 †BUFFALO, N. Y., 1132 Seneca St.
 *BURLINGTON, IOWA, 1708 River St.
 *BURLINGTON, VER., 208 Park Ave.
 *BUTTE, MONTANA, 129 West Park St.
 *BUTTE, MONTANA, 742 Brant Ave.
 *CANTON, OHIO, Market & Tuscarawas Sts.
 ①*CEDAR RAPIDS, IOWA, 507 Longwood Drive, N. E., P. O. Box 148
 †*CHARLOTTE, N. C., 210 East Sixth St.
 ①*CHARLESTON, W. VA., 107 Oakmont St., P. O. Box 865
 *CHATTANOOGA, TENN., 536 Market St.
 *CHICAGO, ILL., 20 N. Wacker Drive
 †CHICAGO, ILL., 2211 W. Pershing Road
 xCHICOPEE FALLS, MASSACHUSETTS
 †CINCINNATI, OHIO, 207 West Third St.
 xCLEVELAND, OHIO, 1216 West Fifty-Eighth St.
 §COLUMBIA, S. C., 912 Lady St.
 *COLUMBUS, OHIO, Gay & Third Sts.
 *DALLAS, TEXAS, 209 Browder St.
 *DALLAS, TEXAS, 1712 Carter St.
 *DAVENPORT, IOWA, 206 E. Second St.
 *DAYTON, OHIO, 30 North Main St.
 *DENVER, COLORADO, 910 Fifteenth St.
 *DENVER, COLORADO, 1700 Sixteenth St.
 †DENVER, COLORADO, 988 Cherokee St.
 ①*DENVER, COLORADO, Gas & Elec. Bldg.
 xDERRY, PA.
 *DES MOINES, IOWA, 523 Sixth Ave.
 †DETROIT, MICH., 5757 Trumbull Ave.
 *DULUTH, MINN., 10 East Superior St.
 ①x*EAST PITTSBURGH, PA.
 *EL PASO, TEXAS, 303 N. Oregon St.
 *EL PASO, TEXAS, 450 Canal St.
 §EL PASO, TEX., c/o Zork Hdwe. Co., 309 N. El Paso St.
 *EMERYVILLE, CALIF., 5815 Peladeau St.
 †EMERYVILLE, CALIF., 1466 Powell St.
 xEMERYVILLE, CALIF., 6161 Green St.
 *ERIE, PA., 1003 State St.
 *EVANSVILLE, IND., 201 N. W. First St.
 †FAIRMONT, W. VA., 602 Cleveland Ave.
 ①FARGO, N. D., 520—3rd Ave. N.
 *FORT WAYNE, IND., 1010 Packard Ave.
 *FORT WORTH, TEXAS, 501 Jones St.
 ①*FRESNO, CALIF., 872 Peralta Way, P. O. Box 632
 *GARY, IND., 701 Washington St.
 *GRAND RAPIDS, MICH., 507 Monroe Ave. N. W.
 *GREENSBORO, N. C., 108 S. Park Drive, P. O. Box 1828.
 *GREENVILLE, S. C., West Earle St.
 *HAMMOND, IND., 235 167th St.
 *HARTFORD, CONN., Main & Pearl Sts.
 *HONOLULU, T. H., Hawaiian Elec. Co. Agt.
 *HOUSTON, TEXAS, 1314 Texas Ave.
 *HOUSTON, TEXAS, 2313 Commerce Ave.
 †HOUSTON, TEXAS, 2315 Commerce Ave.
 ①*HOUSTON, TEXAS, 611-15 Petroleum Bldg.
 †HUNTINGTON, W. VA., 1029 Seventh Ave.
 *INDIANAPOLIS, IND., 137 S. Penna. Ave.
 †INDIANAPOLIS, IND., 551 West Merrill St.
 *ISHPEMING, MICH., 433 High St.
 *JACKSON, MICH., 212 West Michigan Ave.
 †JOHNSTOWN, PA., 47 Messenger St.
 *JOPLIN, MO., 420 School St.
 *KANSAS CITY, MO., 101 W. Eleventh St.
 †KANSAS CITY, MO., 1224 Wyandotte St.
 *KNOXVILLE, TENN., Gay & Clinch St.
 xLIMA, OHIO
 *LITTLE ROCK, ARK., 1115 West 24th St.
 §LITTLE ROCK, ARK., c/o Fones Bros. Hdwe. 2nd & Rock Sts.
 †*LOS ANGELES, CALIF., 420 So. San Pedro St.
 *LOUISVILLE, KY., 332 West Broadway
 *MADISON, WISC., 508 Edgewood Ave.
 xMANSFIELD, OHIO, 200 East Fifth St.
 *MARSHALL, TEXAS, 504 Nathan St.
 *MEMPHIS, TENN., 130 Madison Ave.
 *MIAMI, FLA., 1036 N. Miami Ave.
 *MILWAUKEE, WISC., 546 North Broadway
 †MILWAUKEE, WISC., 1669 N. Water St.
 †*MINNEAPOLIS, MINN., 2303 Kennedy St., N. E.
 *MONROE, LA., 1301 N. Fourth St.
 *NASHVILLE, TENN., 219 N. Second Ave.
 *NEWARK, N. J., 1180 Raymond Blvd.
 †NEWARK, N. J., Haynes Ave. & Lincoln Highway
 xNEWARK, N. J., Plane & Orange St.
 *NEW HAVEN, CONN., 42 Church St.
 †NEW ORLEANS, LA., 333 St. Charles St.
 *NEW ORLEANS, LA., 527 Poydras St.
 *NEW YORK, N. Y., 150 Broadway
 †NEW YORK, N. Y., 460 West Thirty-Fourth St.
 *NIAGARA FALLS, N. Y., 205 Falls St.
 *NORFOLK, VA., 254 Tazewell St.
 *OKLAHOMA CITY, OKLA., 10 E. California St.
 †OKLAHOMA CITY, OKLA., Third & Alie Sts.
 *OMAHA, NEB., 409 South Seventeenth St.
 §OMAHA, NEB., 117 N. 13th St.
 *PEORIA, ILL., 104 E. State St.
 †*PHILADELPHIA, PA., 5001 Walnut St.
 *PHOENIX, ARIZONA, 11 West Jefferson St.
 xPITTSBURGH, PA., Nuttall Works, 200 McCandless Ave.
 z*PITTSBURGH, PA., 306 4th Ave., Box 1017
 †PITTSBURGH, PA., 543 N. Lang Ave.
 *PORTLAND, MAINE, 142 High St.
 *PORTLAND, OREGON, 309 S. W. Sixth Ave.
 †PORTLAND, OREGON, 2138 N. Interstate Ave.
 †PORTLAND, OREGON, 720 N. Thompson St.
 †*PROVIDENCE, R. I., 16 Elbow St.
 *RALEIGH, N. C., 805 North Person St.
 ①*RALEIGH, N. C., P. O. Box 443
 †READING, PA., 619 Spruce St.
 *RICHMOND, VA., Fifth & Byrd
 *ROANOKE, VA., 726 First St., S. E.
 *ROCHESTER, N. Y., 410 Atlantic Ave.
 *ROCKFORD, ILL., 130 South Second St.
 *SACRAMENTO, CALIF., 1805 20th St.
 *SALT LAKE CITY, UTAH, 10 West First South St.
 †SALT LAKE CITY, UTAH, 346 A Pierpont Ave.
 ①SALT LAKE CITY, UTAH, McCormick Bldg.
 *SAN ANTONIO, TEXAS, 115 W. Travis St.
 *SAN FRANCISCO, CALIF., 1 Montgomery St.
 *SEATTLE, WASH., 603 Stewart St.
 †SEATTLE, WASH., 3451 East Marginal Way
 xSHARON, PA., 469 Sharpville Ave.
 *SIOUX CITY, IOWA, 2311 George St.
 *SOUTH BEND, IND., 216 East Wayne St.
 §SOUTH BEND, IND., 107 E. Jefferson St.
 xSOUTH PHILA. WKS., Essington, Pa.
 *SOUTH PHILA. WKS., P. O. Box 7348, Philadelphia, Pa.
 *SPOKANE, WASH., So. 158 Monroe St.
 *SPRINGFIELD, ILL., 601 E. Adams St., Box 37
 †SPRINGFIELD, MASS., 395 Liberty St.
 xSPRINGFIELD, MASS., 653 Page Boulevard
 †ST. LOUIS, MO., 411 North Seventh St.
 †ST. LOUIS, MO., 717 South Twelfth St.
 xST. LOUIS, MO., 5850 Bingham Ave.
 *SYRACUSE, N. Y., 420 N. Geddes St.
 *TACOMA, WASH., 1023 "A" St.
 *TAMPA, FLA., 417 Ellamae Ave., Box 230
 *TOLEDO, OHIO, 245 Summit St.
 *TULSA, OKLA., 303 East Brady St.
 ①*UTICA, N. Y., 113 N. Genesee St.
 *WASHINGTON, D. C., 1434 New York Ave., N. W.
 *WATERLOO, IOWA, 328 Jefferson St., P. O. Box 598
 *WICHITA, KAN., 233 So. Francis Ave.
 *WILKES-BARRE, PA., 267 N. Pennsylvania Ave.
 *WORCESTER, MASS., 32 Southbridge St.
 *YORK, PA., 143 So. George St.
 *YOUNGSTOWN, OHIO, 25 E. Boardman St.

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① WESTINGHOUSE ELECTRIC SUPPLY COMPANY

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 BANGOR, MAINE, 175 Broad St.
 BINGHAMTON, N. Y., 87 Chenango St.
 BOSTON, MASS., 76 Pearl St.
 BURLINGTON, VT., 208 Flynn Ave.
 BUTTE, MONTANA, 50 East Broadway
 CHARLOTTE, N. C., 210 East Sixth St.
 CHICAGO, ILL., 113 North May St.
 CLEVELAND, OHIO, 3950 Prospect Ave.
 COLUMBIA, S. C., 915 Lady St.
 DALLAS, TEXAS, 409 Browder St.
 DES MOINES, IOWA, 218 W. Second St.
 DETROIT, MICH., 547 Harper Ave.
 DULUTH, MINN., 308 W. Michigan St.
 EVANSVILLE, IND., 201 N. W. First St.
 FLINT, MICH., 1314 N. Saginaw St.
 FORT WORTH, TEXAS, 501 Jones St.
 GRAND RAPIDS, MICH., 507 Monroe Ave., N. W.
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 JACKSONVILLE, FLA., 37 South Hogan St.
 LOS ANGELES, CALIF., 905 East Second St.
 MADISON, WISC., 1022 E. Washington Ave.
 MIAMI, FLA., 1036 North Miami Ave.
 MEMPHIS, TENN., 366 Madison Ave.
 MILWAUKEE, WISC., 546 N. Broadway
 MINNEAPOLIS, MINN., 215 South Fourth St.
 NEWARK, N. J., 49 Liberty St.
 NEW HAVEN, CONN., 240 Cedar St.
 zNEW YORK, N. Y., 150 Varick St.
 NORFOLK, VA., 254 Tazewell St.
 OAKLAND, CALIF., Tenth & Alice Sts.
 OKLAHOMA CITY, OKLA., 10 E. California St.
 OMAHA, NEB., 117 North Thirteenth St.
 PEORIA, ILL., 104 East State St.
 PHILADELPHIA, PA., 1101 Race St.
 PHOENIX, ARIZONA, 315 West Jackson St.
 PORTLAND, OREGON, 134 N. W. Eighth Ave.
 PROVIDENCE, R. I., 66 Ship St.
 RALEIGH, N. C., 322 S. Harrington St.
 READING, PA., 619 Spruce St.
 RICHMOND, VA., 301 South Fifth St.
 ROANOKE, VA., 726 First St., S. E.
 ROCHESTER, N. Y., 240 St. Paul St.
 ST. LOUIS, MO., 1011 Spruce St.
 ST. PAUL, MINN., 145 East Fifth St.
 ①SACRAMENTO, CALIF., 20th and R Sts.
 SALT LAKE CITY, UTAH, 235 West South Temple St.
 SAN ANTONIO, TEXAS, 1201 E. Houston St.
 SAN FRANCISCO, CALIF., 260 Fifth St.
 SEATTLE, WASH., 558 First Ave., South
 SIOUX CITY, IOWA, 1005 Dace St.
 SPOKANE, WASH., 152 So. Monroe St.
 SPRINGFIELD, MASS., 46 Hampden St.
 SYRACUSE, N. Y., 961 W. Genesee St.
 TAMPA, FLA., 417 Ellamae St.
 TOLEDO, OHIO, 812 Lafayette St.
 TRENTON, N. J., 245 N. Broad St.
 TULSA, OKLA., 303 East Brady St.
 UTICA, N. Y., 113 N. Genesee St.
 WASHINGTON, D. C., 1216 "K" St., N. W.
 WATERLOO, IOWA, 328 Jefferson St.
 ①WICHITA, KANSAS, 233 So. Francis Ave.
 WILMINGTON, DEL., 216 E. Second St.
 WORCESTER, MASS., 24 Southbridge St.
 YORK, PA., 143 S. George St.

* Sales Office † Service Shop x Works # Warehouse ° First Class Mail Only § Merchandising Products Only z Headquarters ‡ Apparatus Products Only ① Changed or added since previous issue.



① WESTINGHOUSE AGENT JOBBERS

ABILENE, KAN., Union Electric Co.
AKRON, OHIO, The Moock Electric Supply Co.
BIRMINGHAM, ALA., Moore-Handley Hdwe. Co.
BLUEFIELD, W. VA., Superior-Sterling Co.
BUFFALO, N. Y., McCarthy Bros. & Ford
CANTON, OHIO, The Moock Electric Supply Co.
†CHATTANOOGA, TENN., Mills & Lupton Supply Co.
CHICAGO, ILL., Hyland Electrical Supply Co.

CINCINNATI, OHIO, The Johnson Electric Supply Co.
§COLUMBUS, OHIO, The Hughes Peters Electric Corporation
COLUMBUS, OHIO, Pixley Electric Supply Co.
†DENVER, COL., The Mine & Smelter Supply Co.
EL PASO, TEX., Zork Hardware Co.
ERIE, PA., Star Electrical Co.
HUNTINGTON, W. VA., Banks-Miller Supply Co.
KANSAS CITY, MO., Columbian Elec'l Co.

KANSAS CITY, MO., Continental Elec. Co.
LOUISVILLE, KY., Tafel Electric Co.
MONROE, LA., Monroe Hardware Co.
†NASHVILLE, TENN., Tafel Electric Co.
NEW ORLEANS, LA., Electrical Supply Co.
NEW YORK, N. Y., Times Appliance Co., Inc.
PITTSBURGH, PA., Iron City Electric Co.
SAN DIEGO, CALIF., The Electric Supplies Distributing Co.
SCRANTON, PA., Penna. Elect'l Engineering Co.
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x BELLEVILLE, N. J., 720 Washington Ave.
zx BLOOMFIELD, N. J., Clearfield Ave.
*BOSTON, MASS., 10 High St.
*BOSTON, MASS., 12 Farnsworth St.
*BUFFALO, N. Y., 295 Main St.
*CHICAGO, ILL., 20 North Wacker Drive
*CHICAGO, ILL., 2211 W. Pershing Road
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*CLEVELAND, OHIO, 1216 W. 58th St.
*COLUMBUS, OHIO, Gay & Third St.
*DALLAS, TEXAS, 209 Browder St.
*DAVENPORT, IOWA, 206 East Second St.
*DENVER, COLO., 910 Fifteenth St.
*DES MOINES, IOWA, 218 West Second St.
‡DETROIT, MICH., 5757 Trumbull Ave.

*EMERYVILLE, CALIF., 1446 Powell St.
*HOUSTON, TEXAS, 1314 Texas Ave.
①HUNTINGTON, W. VA., 1029 Seventh Ave.
*INDIANAPOLIS, IND., 137 So. Penna. Ave.
*JACKSON, MICH., Consumers Power Bldg.
*KANSAS CITY, MO., 101 W. Eleventh St.
‡LOS ANGELES, CALIF., 420 S. San Pedro St.
*LOUISVILLE, KY., 332 West Broadway
*MEMPHIS, TENN., 130 Madison St.
*MILWAUKEE, WISC., 546 North Broadway
*MINNEAPOLIS, MINN., 2303 Kennedy St., N. E.
*NEW ORLEANS, LA., 333 St. Charles St.
y NEW YORK, N. Y., 150 Broadway
*OKLAHOMA CITY, OKLA., 10 E. California St.
*OMAHA, NEB., 409 So. Seventeenth St.

*PHILADELPHIA, PA., 3001 Walnut St.
*PITTSBURGH, PA., 306 4th Ave., Box 1017
‡PITTSBURGH, PA., Try St. Terminal Bldg.
*ROCHESTER, N. Y., 240 St. Paul St.
*SALT LAKE CITY, UTAH, 10 West First South St.
*SAN FRANCISCO, CALIF., 1 Montgomery St.
*SAN FRANCISCO, CALIF., 60 Federal St.
*SEATTLE, WASH., 603 Stewart St.
*SEATTLE, WASH., 3451 East Marginal Way
*ST. LOUIS, MO., 411 No. Seventh St.
*ST. LOUIS, MO., 717 So. 12th Street
*SYRACUSE, N. Y., 109 So. Warren Street
*TOLEDO, OHIO, 245 Summit St.
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COLUMBUS, OHIO, Gay & Third St.

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*RIO DE JANEIRO, BRAZIL, Caixa Postal 687
*SANTIAGO, CHILE, Casilla 1897
*SHANGHAI, CHINA, P. O. Box 959
*MILANO, ITALY, Piazza Crispi 3
①WELLINGTON, NEW ZEALAND, 2 Taranaki St.
*LIMA, PERU, Edificio Wiese, Esquina Nunez y Filipinas

*MANILA, P. I., P. O. Box 998
*PANAMA, Republic of Panama, P.O. Box 112
*SAO PAULO, BRAZIL, Caixa Postal 636
*SAN JUAN, Puerto Rico, P. O. Box 1539
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*DETROIT, MICH., 5757 Trumbull Ave.
zx LONG ISLAND CITY, N. Y., 21-16 43rd Ave.
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*MILWAUKEE, WISC., 534 North Broadway
*NEW ORLEANS, LA., 608 Commercial Place

*NEW YORK, N. Y., 173 E. Eighty-Seventh St.
*OMAHA, NEB., 117 N. Thirteenth St.
*PHILADELPHIA, PA., 3001 Walnut St.
① *PITTSBURGH, PA., 3702 Fifth Ave.
*ROCHESTER, N. Y., 41 Chestnut St.
*SAN FRANCISCO, CALIF., 870 Market St.

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zx BRIDGEPORT, CONN., Main Plant, 1421 State St.
x BRIDGEPORT, CONN., Plastics Division Plant, 1105 Railroad Ave.

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‡†HALIFAX, 158 Granville St., Halifax, Nova Scotia, Can.
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*MONTREAL, 1135 Beaver Hall Hill, Montreal, Quebec, Can.
①§MONTREAL, 400 McGill St., Montreal, Quebec, Can.

①†MONTREAL, 1844 William St., Montreal, Quebec, Can.
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